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A COMMON FORM OF FACIAL ASYMMETRY IN THE NEWBORN INFANT; ITS ETIOLOGY AND ORTHODONTIC SIGNIFICANCE

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THE present consideration of the orthodontic significance of facial asymmetry in the newborn is based on a study of 1,425 newborn infants in Los Angeles and Mexico City. Facial asymmetry was observed in relation to the infants' birth order and to congenital cranial osteoporosis, known also as congenital craniotabes. A preliminary report of the study was published in a recent issue of the *Journal of Pediatrics*.[8]

The term "congenital craniotabes" as used in this article denotes the condition of congenital softness of the skull in the newborn infant. Its underlying pathology, first described by Wieland, is referred to as "congenital cranial osteoporosis."

The term "facial asymmetry" denotes that type of asymmetry, often encountered in the newborn infant, which, according to Parmelee, is due to the sustained intrauterine postural pressure effects of a juxtaposed shoulder and jaw. The juxtaposition is manifested by an indentation on the affected side of the infant's neck and a displacement of the mandible to the opposite side. The resulting characteristic malocclusion consists in an overlapping of the alveolar ridges on the affected side and a gaping on the other. The term "facial asymmetry" refers throughout the article to this congenital postural form (Figs. 1, 2, and 3).

The history of clinical studies of such facial asymmetry is brief, although the notion that congenital deformities may be caused by pressure in utero

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dates back at least to Hippocrates.[13] Parmelee first described it in 1931 (Figs. 1, 2, and 3). He later extended his concept of intrauterine postural pressure as a causative mechanism in congenital malocclusions to include micrognathia, most cases of which, he suggested, were due to the sustained juxtaposition of sternum and chin.[47]

Fig. 1.

Fig. 2.

Fig. 1.—Marked asymmetry of the jaws; deep impression of the shoulder under and anterior to the left ear and a concavity of the mandible to the left of the chin. (From Parmelee: Am. J. Dis. Child., November, 1931.)

Fig. 2.—Reproduction of probable intrauterine posture. (From Parmelee: Management of the Newborn, Year Book Publishers, Inc.)

Fig. 3.—Characteristic malocclusion in shoulder-jaw asymmetry; overlapping of alveolar ridges on the affected side and gaping on the other. (Courtesy of Dr. Parmelee.)

Chapple and Davidson, who also viewed pressure as the sole etiological factor in facial asymmetry due to intrauterine posture, demonstrated in 1941 that the juxtaposition of shoulder and jaw could be produced by fetal "positions of comfort" in which one leg, or both, is extended across the body, bring-

ing a foot to one side of the head, and thereby forcing the head against the opposite shoulder (Fig. 4). These investigators have been able to verify a number of "positions of comfort" by means of prenatal roentgenograms, among them a juxtaposition of sternum and chin to which brachygnathia at birth was attributed.[15] Gerry and Sangston, in 1946, reported finding facial asymmetry in 20 per cent of newborn infants. They also reported the occurrence of facial asymmetry in only one of a pair of identical twins, and thus provided further evidence that such facial asymmetry is of mechanical, rather than genetic, origin.

Fig. 4.—"Positions of comfort" demonstrating the production of deviation of the jaw. (From Chapple: Postgrad. Med., May, 1950.)

All of the foregoing observers hold that such facial asymmetry tends to correct itself spontaneously in a period varying from a few weeks[27] to a few months,[45] but the orthodontic literature frequently states that it may persist in sufficient degree to result in permanent malocclusion.[41, 51, 61-63]

The preliminary results of the present study indicated that facial asymmetry was far more frequent among infants with congenital craniotabes than among infants with firm, well-calcified skulls.[8, 49] This suggested that intrauterine pressure is not the sole etiological factor in facial asymmetry, as earlier investigators had believed.[13, 16, 27, 45]

The association of facial asymmetry with congenital craniotabes is of practical pediatric and orthodontic interest for the following reasons:

1. Congenital craniotabes, readily detectable at birth by means of gentle palpation of the infant's head, is a valuable diagnostic sign of osteoporotic facial, as well as cranial, bones since clinical evidence indicates that it is a sign not merely of localized deficient calcification but of a generalized osteoporotic process.[23, 39 40, 49, 65]

2. Certain permanent head asymmetries and dentofacial deformities that have their onset in early infancy, have been ascribed to an osteoporosis of the cranial and facial bones at birth.[28, 31] Increased susceptibility to rickets during the first year of life[6, 36, 48, 65, 66] and to enamel hypoplasia of the deciduous teeth[2, 6, 25, 42, 65] have also been ascribed to deficient bony calcification, or even to an inadequate storage of calcium and phosphorus or vitamin D, at birth.

3. The degree of calcification of the infant's cranial bones, as well as the degree of general bony calcification, may be influenced by prenatal measures, such as maternal diet,[18, 39, 40, 59, 65] exposure to sun,[7, 11, 18, 49] or supplemental administration of vitamin D with or without dicalcium phosphate.[12, 20, 23, 59]

Congenital cranial osteoporosis can be shown here to predispose to congenital dentofacial asymmetry due to intrauterine pressure. There is evidence that, if uncorrected, it similarly may predispose to the early postnatal dentofacial asymmetries that are due to postural and other pressure habits. Accordingly, the following more generalized thesis suggests itself: osteoporosis, or deficient bony calcification, may be an essential factor predisposing the child at any age level to malocclusions that are due to pressure habits. Thus, the present study has implications for preventive orthodontics and orthodontic research.

MATERIAL AND METHODS OF INVESTIGATION

The 1,425 newborn infants studied comprise 875 from the obstetric wards of the Los Angeles County General Hospital and 550 from two municipal hospitals in Mexico City, the Hospital General and Maternidad de las Lomas. The earlier papers[7, 8, 10, 49] reviewed the critical aspects of the subject and presented a detailed description of the investigational methods used.

Briefly, infants were arbitrarily classified into three groups: (1) Infants with "hard" skulls showed no yielding or compressibility of bone on light or moderate palpation; (2) those with "soft" skulls showed a definite yielding or softness (either ''ping-pong'' or ''parchment'' in type) of more than one-half the bony vertex; and (3) those with "transitional" skulls showed all lesser degrees of bony softness no matter how small the area of involvement. The soft-skull group, with the marked forms of cranial softness, and the transitional, with the slight or moderate forms, together constitute the "osteoporotic" skull group.

This classification based upon purely clinical diagnostic criteria is, of course, arbitrary. However, it is as accurate and objective as is possible in a purely clinical investigation, since craniotabes can be much better appreciated by palpation than by roentgenographic visualization.[14]

RESULTS OF THE INVESTIGATION*

The results indicate that facial asymmetry was five times as frequent in infants with soft skulls, and more than twice as frequent in those with tran-

*The reliability of the results obtained was determined by the application of the critical ratio and the Chi square tests. The term "significant" is used to indicate differences having critical ratio values of 2.57 or more and in the Chi square test a P value less than 0.05; "suggestive" having critical ratio values between 1.96 and 2.57; and "non-significant" having critical ratio values less than 1.96 and a P value of 0.05 or more.[7, 34, 38]

sitional skulls, as in those with hard skulls (Table I). The differences are significant according to both the critical ratio and the Chi square test (CR values, 3.08 and 3.77; P value, 0.01–). Thus, the incidence of facial asymmetry increased in direct proportion to the degree of osteoporosis.

TABLE I. DISTRIBUTION OF FACIAL ASYMMETRY AMONG HARD AND OSTEOPOROTIC SKULL GROUPS

	TYPE OF SKULL									
	TOTAL		HARD		TRANSITIONAL		SOFT		TRANSITIONAL PLUS SOFT	
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
Total in the different skull type groups	794	100.0	536	100.0	199	100.0	59	100.0	258	100.0
Distribution of facial asymmetry										
Present	54	6.8	22	4.1	20	10.1	12	20.3	32	12.4
Absent	740	93.2	514	95.9	179	89.9	47	79.7	226	87.6

Facial asymmetry was also investigated in relation to maternal parity or the infant's birth order. It was argued that if facial asymmetry is actually the result of sustained intrauterine postural pressure effects,[13, 16, 27, 45-47] it should occur with greater frequency among first-born infants, i.e., offspring of primiparas, since they are subject to greater intrauterine pressure than later-born, i.e., offspring of multiparas.[1, 19] Table II and Chart 1 show that facial asymmetry was actually twice as frequent among the offspring of primiparas as among those of multiparas, the difference being highly suggestive according to the critical ratio (CR value, 2.34), and significant according to the Chi square test.

TABLE II. DISTRIBUTION OF FACIAL ASYMMETRY IN RELATION TO MATERNAL PARITY AMONG INFANTS WITH HARD AND OSTEOPOROTIC SKULLS

	TYPE OF SKULL									
	TOTAL		HARD		TRANSITIONAL		SOFT		TRANSITIONAL PLUS SOFT	
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
Total primiparas	256	100.0	161	100.0	76	100.0	19	100.0	95	100.0
Distribution of facial asymmetry										
Present	26	10.2	8	5.0	13	17.1	5	26.3	18	18.9
Absent	230	89.8	153	95.0	63	82.9	14	73.7	77	81.1
Total multiparas	496	100.0	342	100.0	114	100.0	40	100.0	154	100.0
Distribution of facial asymmetry										
Present	26	5.2	13	3.8	8	7.0	5	12.5	13	8.4
Absent	470	94.8	329	96.2	106	93.0	35	87.5	141	91.6

The increased incidence of facial asymmetry among offspring of primiparas was observed in the hard-skull group, as well as in the osteoporotic (Table II and Chart 1). However, the increased incidence was marked in the osteoporotic skull groups and only slight in the hard-skull group. Thus, the incidence of facial asymmetry increased 12.8 per cent in the soft-skull

group and only 1.2 per cent in the hard (Table II and Chart 1), indicating that infants with hard, well-calcified, skulls are much more resistant to increased intrauterine pressure.

Similarly, the increased incidence of facial asymmetry in the osteoporotic skull groups was observed among offspring of primiparas, as well as offspring of multiparas (Table II and Chart 1). However, the increased incidence in

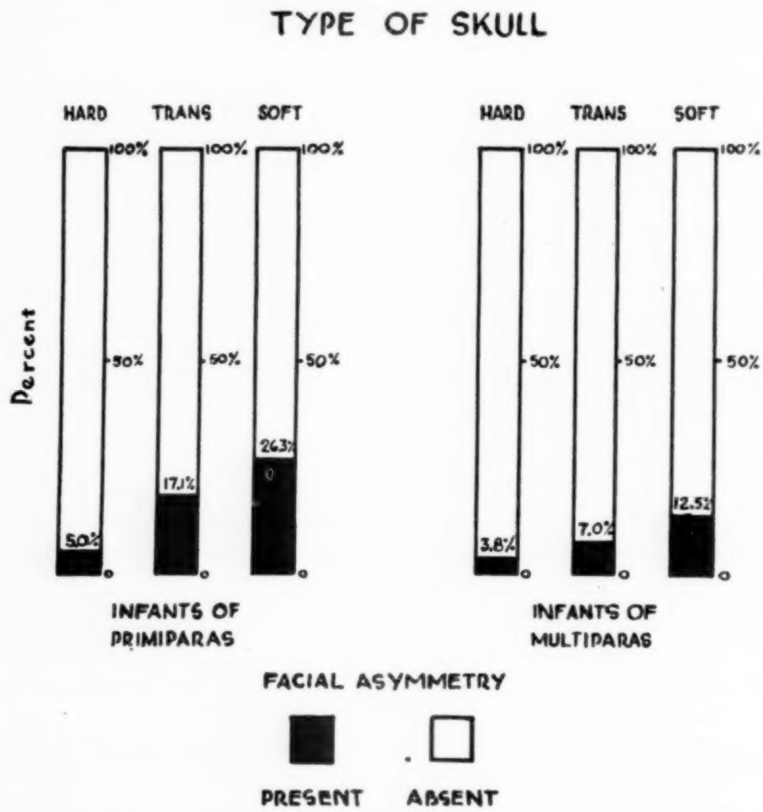

Chart 1.—Incidence of facial asymmetry in relation to maternal parity among infants with hard and osteoporotic skulls.

the osteoporotic skull group was much more marked among offspring of primiparas than among those of multiparas. Thus, among offspring of primiparas facial asymmetry was five times more frequent in infants with soft skulls than in those with hard skulls, whereas among offspring of multiparas it was only three times more frequent in infants with soft skulls than in those with hard (Table II and Chart 1). This further indicates that infants with osteoporotic skulls are much more susceptible to pressure effects. Moreover, the significantly increased incidence of facial asymmetry in the transitional skull group indicates that infants with even minor degrees of osteoporosis are markedly susceptible to pressure effects (Tables I and II and Chart 1).

The consistently more frequent occurrence of facial asymmetry among first-born infants and infants with cranial osteoporosis indicates that both

intrauterine pressure and increased bony plasticity due to osteoporosis are major causative factors.

The relationship of facial asymmetry to congenital craniotabes and to the infant's birth order was corroborated in a supplementary investigation of a series of 535 newborn infants conducted in Mexico City. In this series, of which only 21.1 per cent had osteoporotic skulls, the total incidence of facial asymmetry was 3.2 per cent. Thus, the incidence of both facial asymmetry and cranial osteoporosis was lower in Mexico City than in Los Angeles, where 32.4 per cent had osteoporotic skulls and 6.8 per cent had facial asymmetry.[7, 11, 49] This is consistent with the more favorable sunshine conditions in Mexico City resulting from its lower latitude and higher altitude.[11] The new observations also revealed that facial asymmetry was twice as frequent in infants with osteoporotic skulls (6.2 per cent) as in those with hard skulls (3.3 per cent). Its incidence among 180 offspring of primiparas was 8.3 per cent as compared with 1.7 per cent among 355 offspring of multiparas, the difference being significant with a critical ratio value of 3.06.

Further analysis of the Los Angeles data also indicated that the incidence of facial asymmetry showed a tendency to decrease as the infant's birth order increased. No statistical analysis of these results was made because of the small number of observations.

COMMENT

1. *Orthodontic Significance of Congenital Facial Asymmetry and Cranial Osteoporosis.*—The increased incidence of facial asymmetry among offspring of primiparas supports the theory of mechanical-postural causation proposed by Parmelee and others[13, 16, 27] since, as indicated previously, infants of primiparas are subject to greater intrauterine pressure than those of multiparas.[1, 19] However, the higher incidence of facial asymmetry among infants with craniotabes, independent of parity, clearly indicates that osteoporotic involvement of the facial bones is also a major causative factor. Facial asymmetry manifesting the juxtaposition of shoulder and jaw appears, then, to have a characteristic dual causative mechanism, the intrauterine postural pressure effects being an extrinsic, precipitating factor, and the increased plasticity of facial bones due to congenital osteoporosis being an intrinsic, predisposing factor.

That facial asymmetry occurs at all among infants with hard, well-calcified skulls suggests that occasionally sustained intrauterine postural pressure alone may be responsible for its development, as previously proposed by Parmelee and others.[13, 16, 27] However, this cannot be considered the usual causative mechanism. It probably would operate only under conditions of unusually increased intrauterine pressure. This is borne out by the fact that the incidence of facial asymmetry is much lower among infants with hard skulls as compared with the osteoporotic, and is, moreover, not appreciably affected by the infant's birth order (Tables I and II and Chart 1).

The fact that facial asymmetry occurred in the ratio of 1 to 5 in the hard- and soft-skull groups (Table I) indicates not merely that infants with hard,

well-calcified skulls are comparatively resistant to pressure effects, but that they are, as a rule, sufficiently resistant to escape deformity. It may be said that four out of five of them are not visibly affected by intrauterine pressures that produce gross dentofacial deformities in infants with osteoporotic skulls.

Certain permanent facial asymmetries have been ascribed to excessive molding of the infant's head and face due to abnormal pressure during difficult births.[17, 50] Accordingly, congential osteoporosis also may be a significant factor in facial asymmetries so caused, since it is known to predispose to excessive molding of the head even in normal births.[10, 20, 32, 52]

The "flat head, soft chest" syndrome and certain postural head asymmetries and dentofacial deformities, which frequently have their onset in early infancy, have been ascribed by Hess and Greene, respectively, to an osteoporosis of the affected bones at birth. The increased incidence of facial asymmetry and conically shaped chest[46] among newborn infants with osteoporotic skulls[49] supports their theories.[28, 31] In other words, since congenital cranial osteoporosis predisposes to dentofacial asymmetry and chest deformity due to pressure effects prenatally, it may, if uncorrected, predispose the infant postnatally to the early head and dentofacial deformities that are due to postural pressure habits.

Newer clinical evidence does, in fact, indicate that infants with congenital craniotabes are more susceptible to the head and facial asymmetries, described by Greene, that may result from the sustained pressure of lying habitually on one side. In an adoption agency nursery (The Cradle, Evanston, Ill.), where infants are kept under observation from about the second to the seventh or eighth week of life, Rosenstern noted that such postural head and facial asymmetries were far more frequent among infants with craniotabes than among those with firm, well-calcified skulls. Since these infants were first examined in the neonatal period, the craniotabes observed by Rosenstern is, undoubtedly, of the congenital type, inasmuch as the postnatal or so-called rachitic craniotabes usually makes its first appearance when the infant is 3 or 4 months old.[22, 43] However, even postnatal craniotabes, like frank rickets, leads to pressure deformities, such as flattening of the occiput or occipitoparietal flattening with head and facial asymmetry, in infants who show a sustained postural pressure habit.[14, 61, 68]

In addition, such postural pressure deformities have been found to be far more frequent among premature infants than among full-term infants.[9] Furthermore, it is a common clinical observation that the heads and faces of premature infants often become narrowed, apparently due to postural pressure effects. This characteristic narrowing of the head and face in premature infants has been found to persist into later childhood and to be associated with narrowing of the dental arches and a high-arch palate.[9] The susceptibility of premature infants to postural head and dentofacial deformities can be related to their incompletely calcified, osteoporotic, bones at birth and to their characteristic susceptibility to rickets.[7-11, 29, 31, 36, 47]

Congenital cranial osteoporosis thus may explain why head and dentofacial asymmetries or deformities, frequently originating in early infancy,[28, 68] develop as a result of pressure habits such as thumb-sucking, facial sleeping positions, etc., in some infants and not in others, and why they become permanent in some infants and not in others. Since congenital cranial osteoporosis is open to prophylactic[7, 12, 23, 49, 65] as well as therapeutic measures, this concept assumes practical pediatric and orthodontic importance.

On this basis the following routine for the newborn infant, described in greater detail in an earlier investigation,[7] suggests itself anew: (1) complete physical examination of all newborn infants, particularly of those with facial asymmetry, should include a systematic search for craniotabes; (2) whenever craniotabes is found, measures should be taken to secure adequate calcification of the infant's cranial bones by correcting any vitamin D or calcium and phosphorus deficiencies that may exist, utilizing the earlier administration of vitamin D and the larger dosage already standard in the management of the premature infant; (3) early postural measures to prevent flattening of the occiput, head asymmetries, and dentofacial deformities should be taken for premature infants and for all infants with craniotabes who show a sustained postural pressure habit; (4) early postural measures to avoid aggravating an existing facial asymmetry also should be taken in order to facilitate self-correction through the normal growth process.[27] (Postural measures, such as rotating the infant in the crib, are more likely to be effective if the infant's tendency to turn toward the source of light or activity in the room is taken into account.)

A systematic routine for the newborn is not enough. Since the orthodontic literature suggests that congenital facial asymmetry, regardless of origin, may persist in sufficient degree to produce malocclusion,[41, 51, 61, 63] it is as important to prevent the congenital forms of facial asymmetry as the postnatal forms. This study, and the previous ones, support the administration of supplemental vitamin D to the mother prenatally[7, 8, 10] as an effective preventive measure against congenital cranial osteoporosis and facial asymmetry. Thus, this study supports the current trend in preventive orthodontics which suggests that the prevention of malocclusion can and should begin before birth.[3, 33, 51]

2. *Clinical Application of the Results to Malocclusions Due to Pressure Habits at Later Age Levels.*—This study has additional, broader implications for preventive orthodontics and orthodontic research, since it suggests new insights into the etiological mechanism of malocclusions due to pressure habits at later age levels. Orthodontists and pediatricians differ in regard to the role of dentofacial pressure habits in the development of malocclusion. The orthodontist, who regularly sees the permanent effects of pressure habits tends to overemphasize their role, whereas the pediatrician, seeing the many children who are not permanently affected, or not affected at all, by similar pressure habits tends to underestimate or even disregard their role. There is obvious need for a new approach to the problem of dentofacial pressure habits, an approach that can unify the valid observations of both the orthodontist and the pediatrician and lead to a common point of view.

A pediatrician's appraisal of what this study can contribute to evolving a common point of view follows. Essentially, it is a projection of the basic findings on the newborn into later age levels, used as a means of exploring further the orthodontic implications of the present study. Supported by much in the available literature, this projection serves to highlight certain areas in which new orthodontic research is vitally needed.

First, by demonstrating the marked susceptibility of infants with even minor degrees of cranial osteoporosis to facial asymmetry that manifests intrauterine pressure, this study suggests that deficient bony calcification, irrespective of the cause and the degree, may be an essential factor predisposing the child at later age levels to malocclusions due to pressure habits.

For early infancy, this thesis finds support in data mentioned in the first part of the "Comment" section of this article. For later age levels, there is general consensus, verified by abundant clinical evidence, that bone softened by rickets predisposes the child to dentofacial pressure effects, and that children with poorly mineralized bones are poor orthodontic risks.[3, 4, 21, 33, 51, 53, 54, 55, 61, 64] In addition, the open-bite that is usually attributed to thumb-sucking has also been regarded as a characteristic malocclusion of rickets.[51, 55] Sigel found low calcium and phosphorus levels in children with all types of malocclusion, including those due to thumb-sucking. He concluded that decreased bony density resulting from faulty mineral metabolism is a major factor in malocclusion.

In view of the supporting clinical evidence, the role of deficient bony calcification at later age levels may appear to be obvious. However, deficient bony calcification has been shown in this study to be a major predisposing factor, rather than merely a minor or contributory one. In addition, the findings here encompass not merely gross, or pathologic, deficiencies but deficiencies well within the accepted normal physiologic range, for normal newborn infants with even minor degrees of cranial osteoporosis showed a significantly increased incidence of facial asymmetry. It is generally recognized that the degree of bony calcification varies widely in the normal child at any age level and that, even in the absence of systemic disease, mild subclinical deficencies may occur depending on diet, supplementation of diet with vitamin D, and rate of growth.[34, 54, 58, 60, 61, 64]

Second, by demonstrating that four out of five infants with well-calcified skulls apparently are unaffected by intrauterine pressures that produce gross dentofacial deformity in infants with osteoporotic skulls, this study suggests that normal, well-calcified bones are resistant to pressure effects and may protect the child against malocclusion at later age levels.

This thesis finds support in the pediatrician's experience that most normal children are not permanently affected, or not affected at all, by pressure habits. Further, by logical extension from the orthodontist's experience that poorly calcified bone is more susceptible to pressure effects,[51, 55, 61, 62] it has been surmised in the orthodontic literature, from time to time, that normal, well-calcified bone may resist pressure sufficiently to escape deformity.[51, 56] However,

this view has not gained wide acceptance in practice. This may be due to the paucity of reported long-term investigations dealing with the effects of dentofacial pressure habits on the normal child.

In one of the few such long-term investigations, Sillman has demonstrated that children with good bites resist deformity due to thumb-sucking, whereas children with poor bites usually do not. This is consistent with the present study. Even granting that the character of the bite may be genetically determined, a good bite is still more likely to be associated with good bony calcification than a poor bite.

Third, by establishing that pressure and increased bony plasticity due to osteoporosis are dual factors that interact in utero to produce facial asymmetry in the newborn infant, this study suggests that a like dual causative mechanism may underlie malocclusions due to pressure habits at later age levels. Certainly the essential factors involved, i.e., abnormal pressure and osteoporosis, may be present at any age level.

The etiological concept that arises out of this study is that the dual mechanism is the usual one. This concept does not deny that pressure alone, if severe or sustained enough, may produce gross deformity in well-calcified bone, but holds that this is the exception. Neither does the concept deny the important role of genetic factors, nor the role of any of the other factors referred to as contributory in the orthodontic literature such as "intensity and duration of the habit," "pliability of the jaw bones," "osteogenic development," "genetic endowment," "nutritional factors," "endocrine dysfunctions," and "general state of health."[35, 51] Indeed, it would appear that most of the factors viewed as contributory in the development of malocclusion due to pressure habits are classifiable, on analysis, as factors related either to pressure or to bony calcification.

The etiological concept that arises out of this study, with its emphasis on the resistance of normal, well-calcified bone, suggests a broader and more practical orientation toward the management of pressure habits at later age levels. Far from disregarding the role of pressure habits, this orientation would seek to minimze their detrimental effects through good bony calcification. It thus places increased emphasis on insuring normal, and preferably optimal, calcification in children with pressure habits, and lessened emphasis on correcting pressure habits. In fact, in the presence of good calcification the correction of pressure habits might be viewed as unnecessary unless they are excessive or sustained, and even then, in accordance with current trends, the approach to their management would be psychological.

More specifically, this orientation calls for a systematic diagnostic appraisal of the bony calcification and the calcium and phosphorus metabolism in children with sustained pressure habits who show early evidence of resulting malocclusion. Whenever signs of deficiency are found on orthodontic appraisal,[60] pediatric supervision and therapy, of course, are indicated. However, current trends in preventive orthodontics place measures to ensure optimal calcification in normal children, through diet and supplemental vitamin

D in the standard prophylactic dose (400 to 800 I.U. daily), within the scope and the responsibility of the orthodontist.[33,51] Both the pediatric and the orthodontic literature indicate that these measures are required for all children throughout the period of growth,[2,30,33,51] and not merely for children with pressure habits. It is the general consensus that supplementing the diet with calcium and phosphorus compounds is not usually indicated since, unlike vitamin D, the calcium and phosphorus requirements can be readily fulfilled through diet.[2,30,51]

The foregoing orientation would counteract the tendency to overemphasize pressure habits and would permit management to be much more individualized. It also would simplify management, since prophylactic and therapeutic measures to ensure good bony calcification are far easier to carry out, and much more practical, than measures to correct persistent pressure habits. The psychological advantages that might accrue are not inconsiderable. Much of the confusion connected with the management of pressure habits and much of the anxiety that overemphasizing them introduces for the mother and child might be avoided.

The orientation toward the problem of pressure habits that arises out of this study may be verified directly for later age levels only by long-term clinical investigations undertaken jointly by orthodontists and pediatricians. However, its clinical application finds support in the literature and offers the immediate advantage of placing new emphasis on ensuring optimal calcification for children with pressure habits as a fundamental protective measure against malocclusion.

A new emphasis is needed. The recognition of the importance of good bony calcification, though widespread among orthodontists and pediatricians, has not been *systematically* applied to the management of the child with pressure habits or to explaining why some children develop malocclusions as a result of pressure habits, while others with similar habits do not. The numerous articles on pressure habits, notably thumb-sucking, that appear in the leading orthodontic and pediatric literature continue to be concerned primarily, if not entirely, with the pressure habit itself, its role, and management,[5,35,37,38,44,57,67,69] without practical concern for the underlying bony calcification and without resolving the persisting controversy.

An orientation toward the problem of dentofacial pressure habits that emphasizes the underlying bony calcification helps to unify the divergent experience of orthodontists and pediatricians, and to combine their valid observations into a common point of view. Perhaps this, in itself, enhances the likelihood that such an orientation is valid.

SUMMARY

This study of congenital facial asymmetry manifesting the juxtaposition of shoulder and jaw in utero is based on a series of 1,425 nonselected, apparently full-term newborn infants of Los Angeles and Mexico City. It estab-

lishes the relationship of such facial asymmetry to congenital craniotabes, or clinically demonstrable congenital cranial osteoporosis, and to the infant's birth order.

Recognition of the orthodontic significance of facial asymmetry and cranial osteoporosis in the newborn infant provides a new basis for investigating further their etiological relationship to the early postnatal head and dentofacial deformities that are due to postural pressure habits.

Systematic search for craniotabes is urged as part of the routine physical examination of all newborn infants, and particularly of those with facial asymmetry. A diagnostic and therapeutic routine for the newborn infant with both facial asymmetry and craniotabes, or craniotabes alone, is outlined. The importance of prenatal preventive measures is emphasized.

It is proposed that the etiological mechanism that underlies dentofacial asymmetry in the newborn may be applicable to malocclusions due to pressure habits at later age levels. Supportive evidence is cited. This etiological approach offers immediate advantages in resolving much of the persisting controversy regarding the role and management of pressure habits.

CONCLUSIONS

1. Facial asymmetry in the newborn infant that manifests the juxtaposition of shoulder and jaw in utero shows a striking predilection for infants with craniotabes and for offspring of primiparas.

2. Such facial asymmetry appears, then, to have essentially a dual causative mechanism, the dual factors being the intrauterine postural pressure as the extrinsic, precipitating factor and the increased plasticity of facial bones due to osteoporosis as the intrinsic, predisposing factor.

3. The predilection of facial asymmetry for infants with craniotabes supports the existing clinical evidence that infants with an osteoporosis of cranial and facial bones at birth are more susceptible to the early postnatal head and dentofacial deformities that are due to postural pressure habits.

4. Congenital cranial osteoporosis may explain why head and dentofacial deformities, frequently originating in early infancy, develop as a result of pressure habits such as thumb-sucking, facial sleeping positions, etc., and even become permanent, in some infants and not in others.

5. Since avitaminosis D during pregnancy is frequently responsible for the development of congenital cranial osteoporosis, the administration of vitamin D to the mother during pregnancy in order to ensure normal calcification of the infant's cranial bones has practical pediatric and orthodontic importance, and should take its place alongside the now standard administration of vitamin D to the infant postnatally. Thus, this study supports the current trend in preventive orthodontics which suggests that the prevention of malocclusion can and should begin before birth.

6. The concept of the dual causative mechanism that arises out of this study of dentofacial asymmetry in the newborn, may be applicable to mal-

occlusions due to pressure habits at later age levels. Its clinical application may help to resolve much of the persisting controversy regarding the role and management of dentofacial pressure habits, notably thumb-sucking.

7. Ensuring optimal calcification for children with dentofacial pressure habits is given a new emphasis as a fundamental protective measure against malocclusion.

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REFERENCES

1. Abels, H., and Karplus, D.: Ueber die Bedeutung der angeborenen Osteoporose für die Rachitisentstehung, Ztschr. f. Kinderh, **44**: 365, 1927.
2. Abt, A. F.: Pediatric Aspect of Dental Conditions in Childhood, Arch. Pediat. **58**: 210, 1941.
3. Anderson, G. M.: Practical Orthodontics, St. Louis, 1948, C. V. Mosby Company, pp. 153-157.
4. Atkinson, Spencer R.: The Strategy of Orthodontic Treatment, J. A. D. A. **24**: 560, 1937.
5. Bell, B.: Preventing Malocclusion, Baylor Dent. J. **2**: 8, 1952.
6. Bloom, C. J.: Congenital Rickets? Mississippi Doctor **16**: 26, 1939.
7. Boder, E.: Further Studies on the Etiology and Significance of Congenital Cranial Osteoporosis (Craniotabes). I. Monographs of the Society for Research in Child Development **13**: 2, 1948, Evanston, 1949, Child Development Publications.
8. Boder, E.: Facial Asymmetry in the Newborn Infant; Its Relation to Congenital Cranial Osteoporosis (Craniotabes) and Infant's Birth Order, J. Pediat. **40**: 558, 1952.
9. Boder, E.: Relation of Prematurity to the Incidence of Head and Dentofacial Deformities in Infants and Children. (To be published.)
10. Boder, E.: Further Studies in Congenital Cranial Osteoporosis (Craniotabes). II. Its Relationship to Cranial Molding and Duration of Labor, J. Pediat. **41**: 305, 1952.
11. Boder, E.: Further Studies on the Etiology and Significance of Congenital Cranial Osteoporosis (Craniotabes): III. (To be published.)
12. Brehm, W.: Potential Dangers of Viosterol During Pregnancy with Observation of Calcification of Placentae, Ohio State M. J. **33**: 990, 1937.
13. Browne, D.: Congenital Deformities of Mechanical Origin, Proc. Roy. Soc. Med. **29**: 1409, 1936.
14. Caffey, J.: Pediatric X-ray Diagnosis, Chicago, 1946, The Year Book Publishers.
15. Chapple, C. C.: Abnormalities of Infants Resulting from Non-Genetic Factors, Postgrad. Med. **7**: 323, 1950.
16. Chapple, C. C., and Davidson, D. T.: A Study of the Relationship Between Fetal Position and Certain Congenital Deformities, J. Pediat. **18**: 483, 1941.
17. Colyer, F.: Labour and Dental Deformities, D. Record **53**: 13, 1943.
18. Coons, C. M., Schiefelbush, A. T., Marshall, G. B., and Coons, R. R.: Studies in Metabolism During Pregnancy, Bulletin 223, Oklahoma Agricultural and Mechanical College, Agricultural Experiment Station, 1935.
19. Davison, M. A.: Adequate Prenatal Care, Texas State J. Med. **30**: 706, 1935.
20. Dieckmann, W. J., and Swanson, W. W.: Dietary Requirements in Pregnancy, Am. J. Obst. & Gynec. **38**: 523, 1939.
21. Eggnatz, M.: Rickets—Caries, Hypoplasia, and Malocclusions of the Teeth, Am. J. Orthodontics and Oral Surg. **27**: 379, 1941.
22. Eliot, M. M., and Park, E. A.: Rickets, in Brennemann, J.: Practice of Pediatrics, vol. 1, Hagerstown, Md., 1937, W. F. Prior Company, Inc., chap. 36, pp. 1-110.
23. Finola, G. C., Trump, R. A., and Grimson, M.: Bone Changes in the Fetus Following the Administration of Dicalcium-Phosphate and Viosterol to the Pregnant Mother, Am. J. Obst. & Gynec. **34**: 955, 1937.
24. Fisher, R. A.: Statistical Method for Research Workers, London, 1929, Oliver & Boyd.
25. Freudenberg, E.: Rickets and Tetany, in von Pfaundler, M., and Schlossman, A.: The Diseases of Children, vol. 2, translated by M. G. Peterman, Philadelphia, 1935, J. B. Lippincott Company, pp. 71-138.
26. Garrett, H. E.: Statistics in Psychology and Education, New York, 1947, Longmans, Green & Co.
27. Gerry, R. G., and Sangston, R. E.: Congenital Mandibular Deformities in Newborn Infants, Am. J. Orthodontics and Oral Surg. **32**: 439, 1946.

28. Greene, D.: Asymmetry of the Head and Face in Infants and Children, Am. J. Dis. Child. **41**: 1317, 1931.
29. Hamilton, B.: Cited by Eliot, M. M., and Park, E. A., Rickets, in Brennemann, J.: Practice of Pediatrics, vol. 1, Hagerstown, Md., 1937, W. F. Prior Company, Inc., chap. 36, pp. 1-110.
30. Hansen, A. E.: Nutritional Requirements and Digestion, Mitchell-Nelson, Textbook of Pediatrics, Philadelphia, 1950, W. B. Saunders Co., pp. 87-123.
31. Hess, J. H.: The Premature Infant, in Brennemann, J.: Practice of Pediatrics, vol, 1, Hagerstown, Md., 1946, W. F. Prior Company, Inc., chap. 43, pp. 1-51.
32. Holland, E.: (a) cited by von Haam, E.: Pathology of Intracranial Hemorrhage in the Newborn Child, Am. J. Obst. & Gynec. **27**: 184, 1934, and (b) cited by Strong, R. A.: Birth Injuries, Internat. M. Digest. **35**: 119, 1939.
33. Howe, P. R.: Nutrition and Bone Growth, Angle Orthodontist **8**: 209, 1938.
34. Johnston, J. A.: Osteoporosis in Adolescence Due to Rapid Growth, Am. J. Dis. Child. **59**: 287, 1940, and **62**: 708, 1941.
35. Klein, E. T.: Pressure Habits, Etiologic Factors in Malocclusion, AM. J. ORTHODONTICS **38**: 569, 1952.
36. Levine, S. Z.: The Premature Infant, Mitchell-Nelson Textbook of Pediatrics, Philadelphia, 1950, W. B. Saunders Co., pp. 359-363.
37. Littlefield, W. H.: Thumb-sucking and Its Relationship to Malocclusion in Children, AM. J. ORTHODONTICS **38**: 293, 1952.
38. Mack, E. S.: Dilemma In Management of Thumb-sucking, J. A. D. A. **43**: 33, 1951.
39. Maxwell, J. P., Hu, C. H., and Turnbull, H. M.: Foetal Rickets, J. Path. & Bact. **35**: 419, 1932.
40. Maxwell, J. P., Pi, H. T., Lin, H. A., and Kuo, C. C.: Further Studies in Adult Rickets (Osteomalacia) and Fetal Rickets, Proc. Roy. Soc. Med. **32**: 287, 1939.
41. McCoy, J. D.: Applied Orthodontia, Philadelphia, 1927, Lea & Febiger, p. 69.
42. Mellanby, M.: Effect of Diet (Antenatal and Postnatal) on Structure of Teeth and Incidence of Dental Caries, Tr. Edinburgh Obst. Soc., 1928-1929, p. 25, in Edinburgh M. J., March, 1929.
43. Moore, C. U., and Dennis, H. G.: Craniotabes: Its Prevalence and Significance, Am. J. Dis. Child. **30**: 683, 1925.
44. Noyes, H. J., and Langford, W. S.: Round Table Discussion on Sucking Habits and Deformities of Dental Arches, J. Pediat. **17**: 122, 1940.
45. Parmelee, A. H.: Molding Due to Intrauterine Posture; Facial Paralysis Probably Due to Such Molding, Am. J. Dis. Child. **42**: 1155, 1931.
46. Parmelee, A. H.: The Newborn Child, in Curtis, A. H.: Obstetrics and Gynecology, vol. 1, Philadelphia, 1933, W. B. Saunders Co., pp. 880-883.
47. Parmelee, A. H.: Management of the Newborn, Chicago, 1952, Year Book Publishers, Inc., pp. 284-285.
48. Rector, J. M.: Prenatal Influence in Rickets. I. Fetal Rickets, J. Pediat. **6**: 161, 1935. II. Early Postnatal Rickets and Florid Rickets with Multiple Fractures, J. Pediat. **6**: 167, 1935.
49. Reiss, O., and Boder, E.: Congenital Cranial Osteoporosis: Its Etiology and Significance, Am. J. Dis. Child. **59**: 131, 1940.
50. Ramaker, R. E.: The Effect of Abnormal Pressure Factor During Birth Upon the Maxilla, Nasal Bones and Dental Arches, Northwest Dent. **18**: 150, 1939.
51. Salzmann, J. A.: Principles of Orthodontics, Philadelphia, 1950, J. B. Lippincott Company.
52. Sanders, C.: Intracranial Hemorrhage in the Newborn, J. Obst. & Gynaec. Brit. Emp. **55**: 55, 1948.
53. Schoor, E.: Sigmatism and Malposition of the Teeth, AM. J. ORTHODONTICS AND ORAL SURG. **25**: 1143, 1939.
54. Schour, I., and Massler, M.: The Effects of Dietary Deficiencies Upon the Oral Structures II., J. A. D. A. **32**: 871, 1945, and III., J. A. D. A. **32**: 1022, 1945.
55. Shelling, D. H., and Anderson, G. M.: Relation of Rickets and Vitamin D to the Incidence of Dental Caries, Enamel Hypoplasia and Malocclusion in Children, J. A. D. A. **23**: 840, 1936.
56. Sigel, S. A.: The Biochemical Etiology and Diagnosis of Malocclusion and the Use of Mineralization and Vitamin Therapy in Orthodontic Treatment, AM. J. ORTHODONTICS **25**: 235, 1939.
57. Sillman, J. H.: Thumb-sucking and the Oral Structures, J. Pediat. **39**: 424, 1951.
58. Stearns, G.: Vitamin D, Journal-Lancet **63**: 344, 1943.
59. Swanson, W. W., and Iob, V.: The Growth of Fetus and Infants as Related to Mineral Intake During Pregnancy, Am. J. Obst. & Gynec. **38**: 382, 1939.
60. Tager, B. N.: Endocrine Problems in Orthodontics: Concept of Relative Metabolic Insufficiency in Bone Due to Rapid Skeletal Growth and Slow Sexual Maturation, AM. J. ORTHODONTICS **37**: 867, 1951.

61. Thoma, K. H.: The Effects of Skeletal Diseases on the Jaws and Teeth, Harvard Den. Rec. **11**: 35, 1937.
62. Thoma, K. H.: Clinical Pathology of the Jaws, Springfield, Ill., 1934, Charles C Thomas, pp. 4-5.
63. Thompson, J. R.: Asymmetry of the Face, J. A. D. A. **30**: 1859, 1943.
64. Todd, T. W.: The Mineralization Problem in Orthodontia, Angle Orthodontist **7**: 158, 1937.
65. Toverud, K. U.: Etiology of the Congenital Osteoporosis, Acta paediat. **12**: 267, 1932.
66. Toverud, K. U., and Toverud, G.: Studies on the Mineral Metabolism During Pregnancy and Lactation and Its Bearing on the Disposition to Rickets and Dental Caries, Acta paediat. (supp. 2) **12**: 1, 1931.
67. Veeder, B.: Thumb-sucking, J. Pediat. **39**: 515, 1951.
68. Warkany, J.: Rickets, in Nelson, W. E.: Mitchell-Nelson Textbook of Pediatrics, Philadelphia, 1950, W. B. Saunders Co., pp. 399-414.
69. Whitman, C. L.: Habits Can Mean Trouble, Am. J. Orthodontics **37**: 647, 1951.

1809 Edgecliff Dr.

THE CORRECTION OF A MANDIBULAR MACROGNATHIA BY SURGICAL MEANS

A Study of a Pioneering Operation Performed in 1930 and Predicated Upon Careful Gnathostatic Diagnosis and Orthodontic Preparation

Allen H. Suggett, B.S., D.D.S., Santa Barbara, Calif.*

DURING the month of January in 1930 there came to me for orthodontic consultation a young man whom we shall call D. D. He was 20 years of age and in good health. He was distressed over the fact that his mandible occupied a markedly forward position, and those of us who collaborated in the preliminary study of his case felt that it was definitely overgrown.

Careful records were made which included gnathostatic denture reproductions and photostatic facial reproductions so that the whole situation could be studied objectively. From the evidence thus gained we felt that conventional orthodontic methods of treatment could not produce helpful results of a permanent nature and that surgical means must be utilized if the patient was to be afforded any degree of relief.

Through the careful study of his gnathostatic casts, it was found that if the body of the mandible could be moved posteriorly about 5 mm. the occlusion of opposing teeth would be greatly improved, and this suggested a surgical procedure of cutting through the upper part of both rami and then moving the mandible back one interval. At this point I called in for consultation the late Dr. George Hensel, a brilliant young surgeon and a member of the staff at the University of California School of Medicine. He felt the idea was entirely feasible, so the patient was called in and the plan was outlined to him. He gave his consent to the operation.

Careful orthodontic preparations were made so that the opposing teeth and mandible could be immobilized in a predetermined position. Bands were cemented upon a number of teeth in addition to the first molars so that labial arch wires could be made very secure upon both the upper and lower teeth. Suitable lugs were placed above and below upon the arch wires in positions of advantage so that immobilization could be accomplished by using but one ligature upon each side. This was deemed advisable so that in case of nausea only two wires would have to be cut to make it possible for the mouth to be opened. In furtherance of this precaution, at the time of operation a suitable pair of scissors was stitched to the patient's smock for emergency use.

Accordingly, in keeping with these carefully made plans, the patient entered the University of California Hospital and upon Feb. 15, 1930, the first

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A.

B.

C.

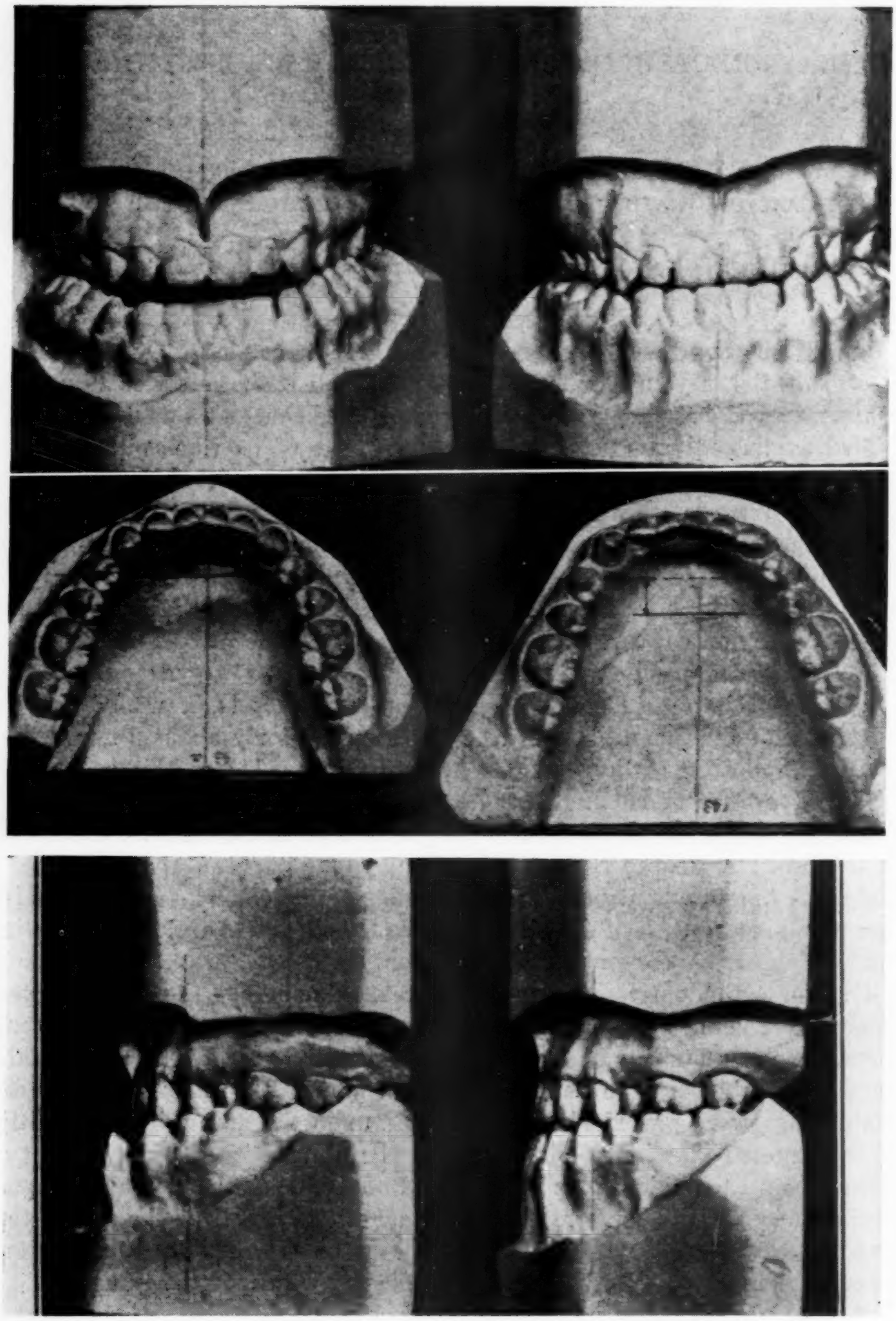

Fig. 1.—*A*, Pre- and postoperative denture records, anterior view; *B*, vertical view of lower denture records showing the extent of posterior shift; *C*, pre- and postoperative lateral view of denture records. All postoperative records were made one year after the operation.

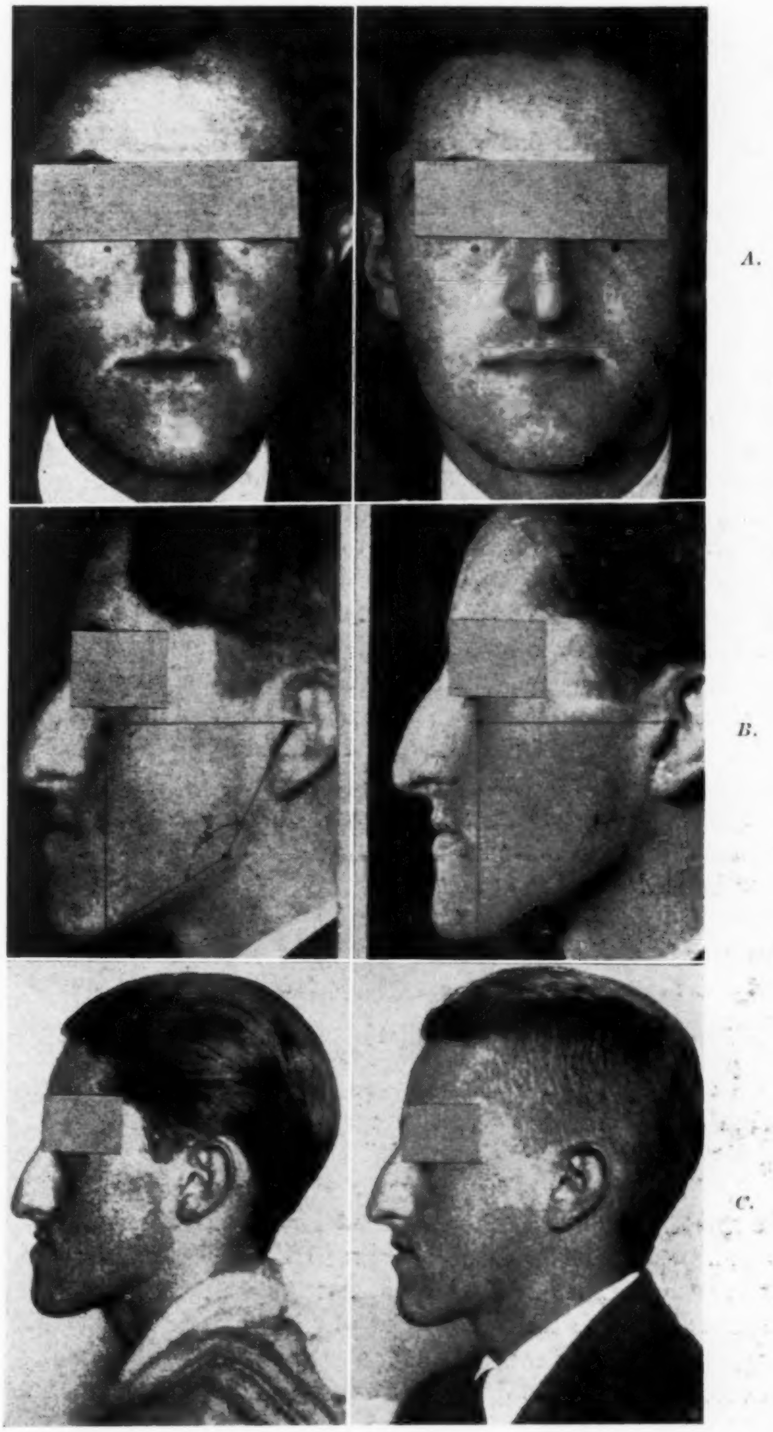

Fig. 2.—*A*, Pre- and postoperative photostatic facial records, front view; *B*, pre- and postoperative photostatic facial records, lateral view; *C*, pre- and postoperative photostatic facial records showing marked esthetic improvement. All postoperative records were made one year after the operation.

stage of the operation was performed. Gas and oxygen and ether were utilized for the anesthesia and Dr. Hensel uncovered the ramus upon the right side. With a dental engine and fine bur I bored a series of holes through the bone on a line parallel with the occlusal plane and then with a crosscut bur connected these holes, thus severing the bone, which Dr. Hensel immediately covered up by closing the wound. Two days later, to be exact on Feb. 17, 1930, the same operation was performed upon the left side. The mandible was then moved posteriorly one interval and supported in place by the labial arch wires connected by a wire ligature upon each side. The changed position of the mandible was further supported by a fairly tight bandage and the patient returned to his room in a satisfactory condition.

In about six weeks he was discharged as a successful case and now 23 years later, that assurance still holds true. In the series of photographs shown in Figs. 1 and 2 the changed relationships of the teeth are made evident and the photostatic facial records likewise show a greatly improved esthetic situation.

Such cases usually are referred to as "mandibular prognathisms," but we have felt that this term, which is borrowed from anthropology and has reference to the facial angle, is not as descriptive as "mandibular macrognathia," which definitely indicates an overgrowth of the part.

Undoubtedly, the operation entitled "osteotomy of the mandible" has been performed many times and various and different techniques have been employed, depending upon the needs revealed by a diagnosis. In this case the operation was predicated upon a diagnosis wherein gnathostatic denture reproductions, photostatic facial records, and careful roentgenographic surveys indicated a favorable prognosis.

AN ANALYSIS OF CEPHALOMETRY

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MUCH has been learned concerning the growth patterns of the human skull in the intervening years since Broadbent first introduced the cephalometer technique in 1931. There is no doubt about the importance of this valuable instrument; it is here to stay and as time goes by it will become as much a part of orthodontic diagnosis as the photograph and the impression.

Although this instrument has not been formally approved by the scientific investigators, it is the most advanced method of interpretation in orthodontics today. The cephalometer has been described in detail many times in orthodontic literature. Therefore, only a brief summary of some essential facts of this machine will be discussed here.

Primarily, the cephalometer is an innovation of anthropometry and radiography applied to an oriented living skull in such a manner that subsequent x-ray pictures of growth areas may be superimposed one upon the other and relatively accurate evaluations of any increase in growth determined. In order to accomplish this, Broadbent erected a head holder that orients the skull with its midsagittal plane exactly five feet from the x-ray machine, and the central axis of the roentgen rays passes directly through the center of both ears. The registration is made on a sensitive film placed at right angles to these rays on the opposite side of the head from the x-ray unit. Another x-ray unit of the same height and distance, but at right angles to the first machine, produces an anterior image on film in which the x-ray unit is behind the skull and the film is in front of the face. In both instances the film is as close to the subject as tissue will permit. The oriented headplates placed side by side in a balanced position aid in the interpretation and correction for distortion. It is noteworthy that the principles of this machine have not been changed since its introduction in 1931, and for the past fifteen years several of the universities in this country have been using the Holly Broadbent machine (cost $6,000, including x-ray) for research purposes. Following the introduction of the Broadbent machine, many farsighted men devised ingenious methods of obtaining their own serial head films. These are the men who have pioneered the use of the simplified machines and have made possible the low-cost machines such as the Higley, Thurow, and Margolis, etc. (cost about $250 to $500).

When Brodie[1] presented his thesis in 1941 titled "On the Growth Pattern of the Human Head," private practitioners turned with great fervor to discover for themselves just what was going on in treatment. It was not long before they arrived at the realization that there were many limitations in the treatment of malocclusions which were often caused by an unfavorable morphogenetic

This thesis, which was given as a partial fulfillment of the requirements for certification by the American Board of Orthodontics, is being published with the consent and the recommendation of the Board, but it should be understood it does not necessarily represent nor express the opinion of the Board.

pattern discernible only in the head films. Prior to Brodie's publication, much of the orthodontist's concept had developed around the theory of stimulating bone growth. Clinically there was a certain amount of proof that mandibles seemed to grow,* but, without cephalometric head films, there was no way of coherently discussing the changes that actually took place.

Between the years of 1941 and 1948 research brought forth additional proof of Brodie's findings, and gradually there has developed the concept of normal and abnormal patterns of facial growth.

Most practicing orthodontists have a natural or acquired sense of esthetic balance. In the past years this perception has enabled them to observe a patient, study the models and photographs, and then visualize the end results that they would wish to produce by treatment of that certain individual. Unfortunately, there were many cases that ended in compromises resulting in disappointments for which there was no qualified reason. As one colleague has so realistically stated, serial head films, taken cephalometrically, allow him to evaluate the potential growth and treatment and so to forestall any misconception in the minds of the patient and the parents that he can do miracles with an adverse growth pattern.

Primarily, the orthodontist must concern himself with the position of the teeth, occlusion, function in all its aspects, and size of teeth and supporting bony structures. This is where cephalometrics becomes an aid in evaluating these unknown quantities.

Wylie,[2] in a statement of what should be considered in cephalometric analysis, writes, "A good start toward such a method of assessment may be made by summing up some of the possible generalizations. We may say that each of the following factors, when greater than average in size, dispose toward a Class II relationship: the length of the cranial base between the glenoid fossa of the temporal bone and the tuberosity of the maxilla, the over-all length of the maxilla, and the position of the maxillary first permanent molar as measured forward from the tuberosity of the maxilla. The only other factor involving absolute size which is to be considered is the over-all length of the mandible, which of course predisposes to the Class II relationship when it is undersized." Wylie then compares the sum total of these related measurements of upper face projected to the Frankfort-horizontal with the mandibular length, which is a measurement tangent to the lower border of the mandible extending from the most anterior point of the chin to a right angle line from the most posterior point of the mandibular condyle. This method of comparison is a relationship of structure in a fixed base which may vary in size within itself but its sum total is so compensated that it can be compared with the over-all length of the functioning unit, the mandible.

Wylie introduced anterior posterior dysplasia and has recognized since its beginning certain discrepancies which failed to describe the unbalances between bases of the functioning units, because slanting line measurements were matched against horizontal line measurements rendering unequal lengths.

*Discussed later (Ref. 12).

A recent, and perhaps a more practical, method is the version introduced by Riedel[3] in which all measurements are made on perpendicular projections parallel to the Frankfort-horizontal in the maxillary as well as the mandibular length. Point A* is used for the maxillary anterior point and Point B* replaces the most anterior point of the chin. While these two methods are a valuable aid in diagnosis, neither Wylie's nor Riedel's method shows the results of treatment.

The Downs analysis,[4] on the other hand, is perhaps the most significant advance in cephalometric analysis yet devised. It is fast becoming the international language of cephalometry.

In this analysis, it is not any single angle that determines the balance, but it is the composite of all the angles which allows one to visualize an image of a subject so described. Fundamentally, the Downs analysis requires accuracy from the beginning of the headplate to the final stage of actual measurements. Careless placement of the ear rods can displace Frankfort-horizontal which is a base line in Downs' analysis. Operators who are using cephalometry in their own offices should understand complete basic principles of this technique in order to standardize head film pictures.

Downs, recognizing that this is a point of error, has suggested in lectures† that many discrepancies in analysis are the result of operators failing to literally hang their patients' heads in the ear rods. This error was noted in the records of one of my own patients when a comparison of the mandibular plane angle was 40 degrees in the headplate, and 32 degrees in the photograph. An examination of the records of the patient disclosed that the ear rods had been placed carefully by the laboratory technician, but that the patient's ear canal made a sharp turn upward at a point deeper than the ear rod insertions. An analysis derived from the lateral headplate is compared separately to a set of figures from a group average of individuals possessing a normal skeletal pattern. The relationship of the denture as well as the skeletal pattern can be compared with norms, and the extent to which the individual patient corresponds or departs from a given set of normal figures determines the degree of departure from recognized good balance and harmony.

A recent innovation by J. W. Adams (Plate I) of the Hellman Wiggle Grid uses the tolerant variations of Downs' normals in which the readings from any case before and after treatment are compared. This is a graphic illustration of the combined changes in growth and treatment. All but one of Downs' values are expressed in angles. This is a measure in millimeters expressing the incisal protrusion or recession related to one of the Downs planes. Points A and B are highly significant in both Riedel and Downs evaluations. Defined, this Point A is an arbitrary measure point taken at the innermost curvature from the maxillary anterior nasal spine to the crest of the maxillary alveolar process. Point B is an arbitrary measure point on the anterior profile curvature from the mandibular anthropometric landmark, pogonion, to the crest of the alveolar process.

*As described in Downs' analysis (defined later).

†University of Washington Postgraduate Course.

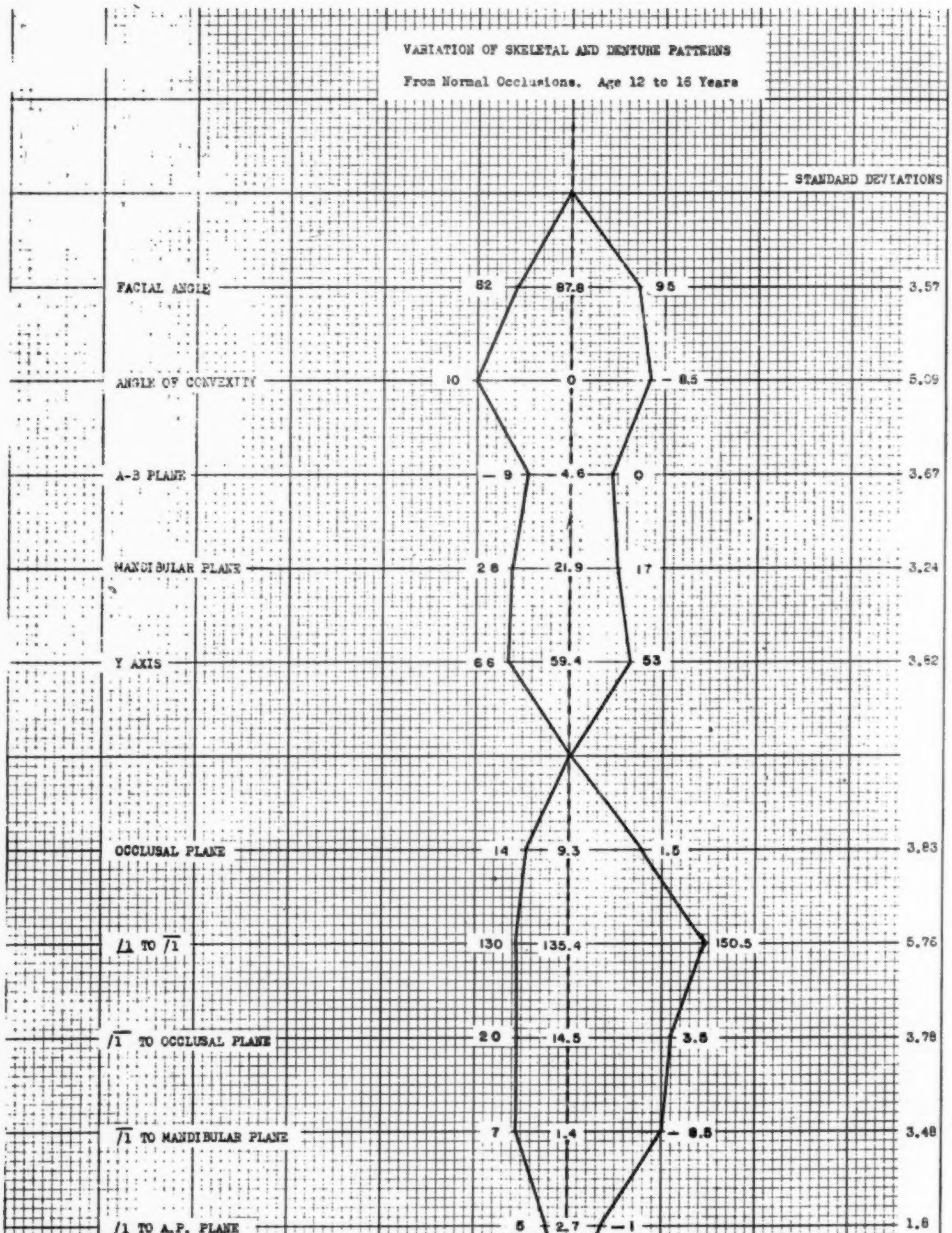
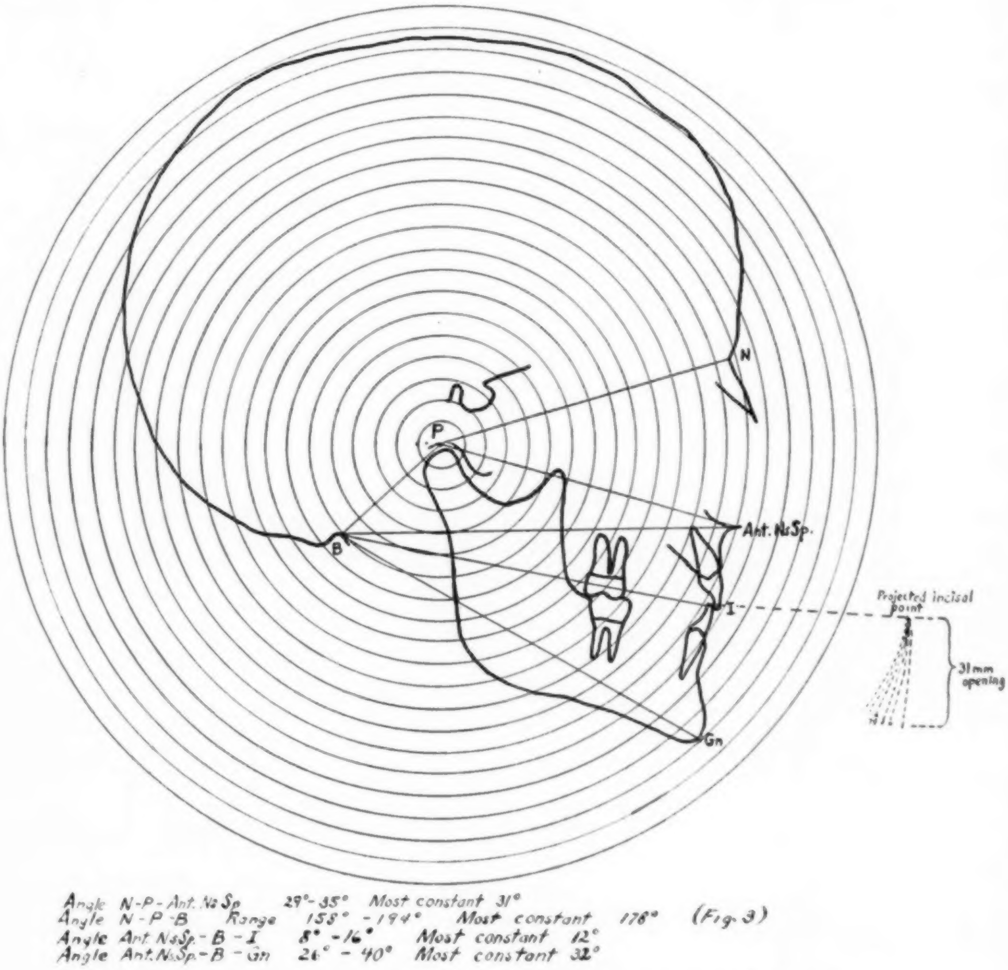

VARIATION OF SKELETAL AND DENTURE PATTERNS
From Normal Occlusions. Age 12 to 16 Years
STANDARD DEVIATIONS
FACIAL ANGLE 82 87.8 95 3.57
ANGLE OF CONVEXITY 10 0 - 8.5 5.09
A-B PLANE - 9 - 4.6 0 3.67
MANDIBULAR PLANE 28 21.9 17 3.24
Y AXIS 66 59.4 53 3.82
OCCLUSAL PLANE 14 9.3 1.5 3.83
1 TO 1 130 135.4 150.5 5.76
1 TO OCCLUSAL PLANE 20 14.5 3.5 3.78
1 TO MANDIBULAR PLANE 7 1.4 - 8.5 3.48
1 TO A.P. PLANE 5 2.7 - 1 1.8
ADAPTATION OF THE HELLMAN "WIGGLE"
SUGGESTED BY DR. J. W. ADAMS

Plate I.

As all new methods of evaluation go through a corrective stage, so too are Downs' figures of norms being reappraised. Also, there is one so-called "bug" in this analysis that of necessity must be corrected. If one is to relate all structure to the whole, then it will be necessary to determine in some fashion the vertical dysplasia as related to the anterior posterior dysplasia. For example, when drawing a profile from a set of Downs' figures all angles of measurement can be established, but the height of the occlusal plane and position of A and B points, as well as the incisal points, must be guessed at.



Angle N-P-Ant. NsSp 29°-35° Most constant 31°
Angle N-P-B Range 158°-194° Most constant 176° (Fig. 3)
Angle Ant. NsSp.-B-I 8°-16° Most constant 12°
Angle Ant. NsSp.-B-Gn 26°-40° Most constant 32°

Path of opening related to occlusal plane Range 68°-92° Most constant 74°

Plate II.

Wylie soon will present a transparent plastic overlay with diverging lines which will utilize the vertical dimension averages as compiled by Johnson.[5] It is possible that this ultimately will become a part of the equipment in making a Downs analysis with some corrective chart being used to correct for anterior nasal spine and A Point.*

*All facial height measurements are related to anterior nasal spine. A Point is unrelated as yet.

Perhaps one of the easiest ways of studying a lateral headplate is to place it under a transparent target overlay with twenty or more ¼ inch concentric circles radiating from a center point. The ear rods are placed in the center of the target, enabling the beginner to appreciate the relationship of the

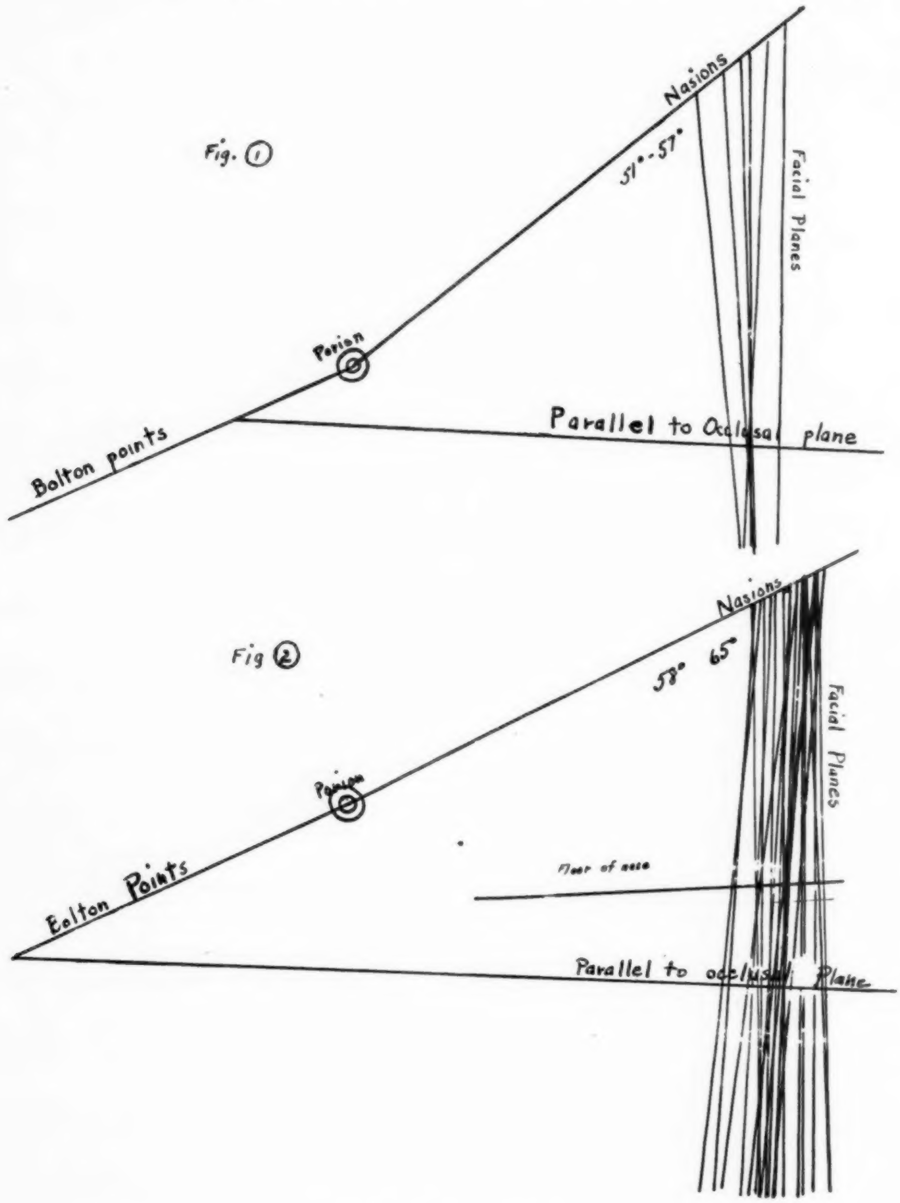
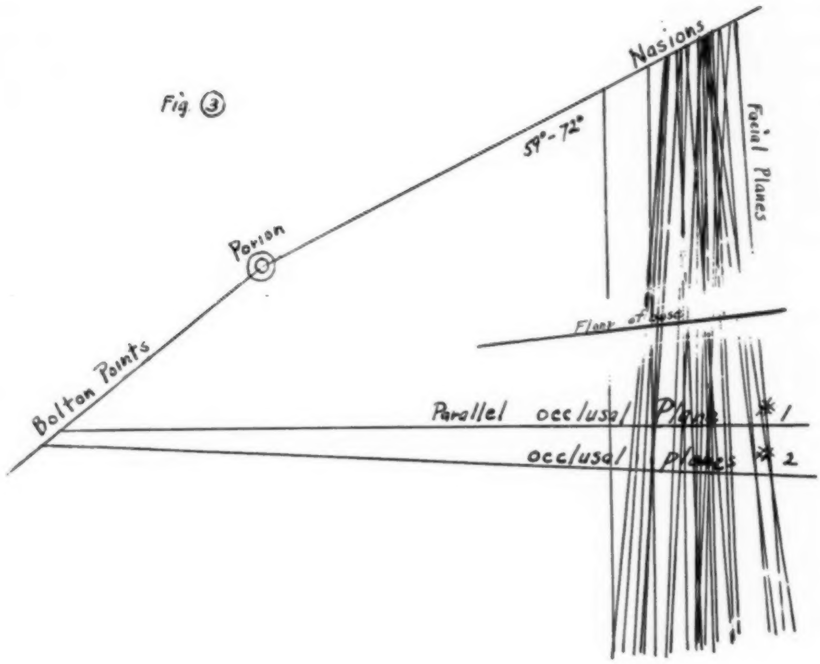


Plate III, Figs. 1 and 2.

important points in cephalometry as well as interpret the relative degree of distortion caused by the diverging x-rays.

In a study of eighty-six head films of all ages, using the center of the ear rods as an axis, it was found that the upper face from nasion to anterior



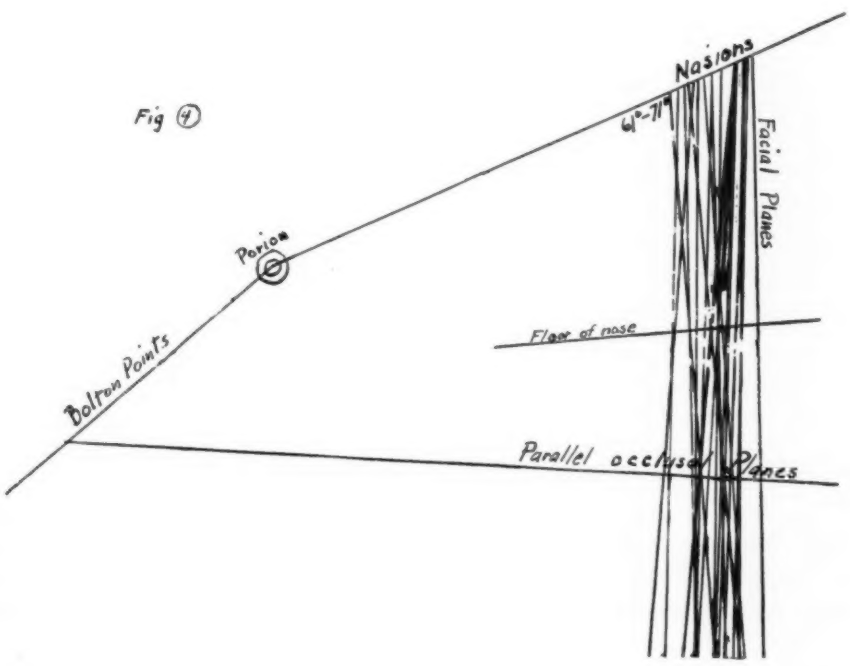


Plate III, Figs. 3 and 4.

nasal spine averaged 31 degrees with a range of 29 degrees to 35 degrees. An angulation of lower face height was taken from the Bolton point and averaged 32 degrees from anterior nasal spine to gnathion with a range of 26 degrees to 40 degrees. This average in the lower face was not as consistent as the angular reading in the upper face and presented a greater range, partially because Bolton point is not in the same constant position, but it offers a relative point from which a registration can be taken. Incisal height from anterior nasal spine as read from the Bolton point averaged 12 degrees with a range of 9 degrees to 16 degrees.

To test the validity of using the Bolton point as a center for the lower face angulation, five separate angles of varying degrees were constructed with the center of the angle just below porion in the center of the superimposed ear rods. This is advantageous because the undistorted x-ray at this point can be projected to the midsaggital measurements without need for compensation.

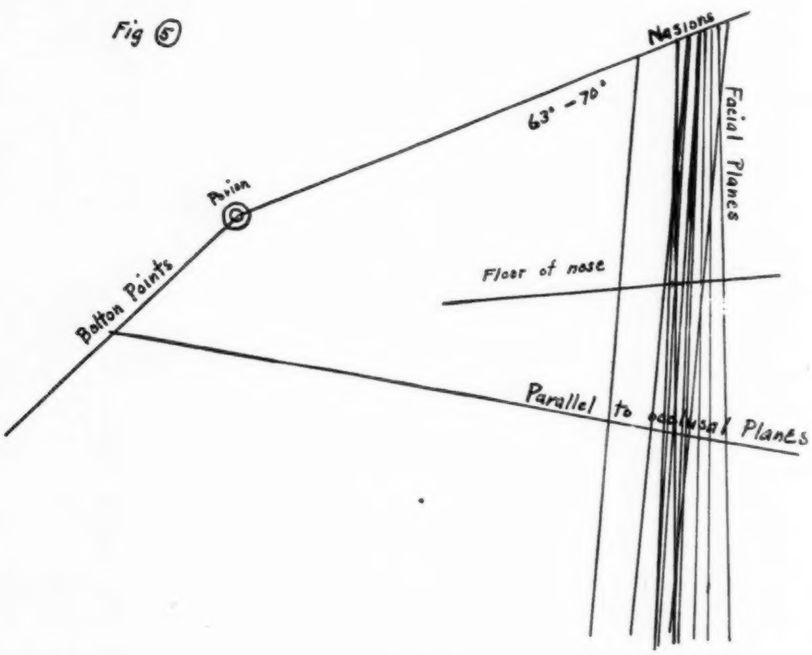


Plate III, Fig 5.

One line of the angle extends to Bolton and the other extends to nasion. (Plate III, Figs. 1, 2, 3, 4, and 5.) Each of the headplates then was typed according to the angulation of N-P-B, and the facial planes were drawn from nasion.

The occlusal plane and floor of the nose were included after it was discovered that there was a high percentage in each classification that could be typed.

A comparison between Fig. 1 and Fig. 5 indicates that the average facial plane angle decreases as the angle N-P-B increases; therefore, Bolton point offers a relative degree of accuracy from which lower face angles can be measured.

It is from the last two readings of Plate II that five types of profiles of vertical heights are suggested by me with upper face height constant.

This vertical height classification can be related to the Downs analysis and registered to any of the present-day methods of classification; also it can be interpreted on a soft tissue, a hard tissue, or a combination of both. This vertical classification A-B-C is correlated to the Angle classification of I, II, and III in that mandibular height and length are similar. Classes D and E depict the over- and underdevelopment of vertical height.

Since the works of Brodie, there has been consistent progress in the field of research regarding the concept of facial growth. New and important light has been focused on the general interpretation that the face grows downward and forward. The facial pattern of any given individual tends to remain rather

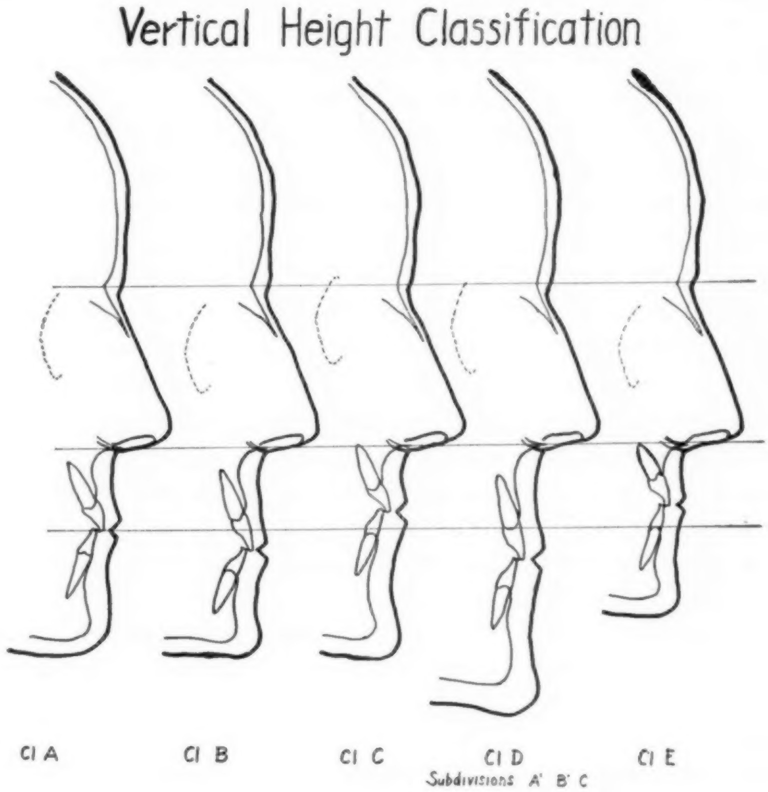


Plate IV.

constant throughout life in normal growth and it is noted that in the post-pubertal period of adolescence the average face tends to swing forward. In making comparative analyses of each face the variations in facial patterns of individuals should be kept in mind at all times.

Petraites[6] has demonstrated statistically that we can expect more forward growth in the face of a boy aged 12 to 13 on into adulthood than that of a girl above the age of 13 years. A remarkable example of the early maturity of girls (one we all have observed but never realized) is the comparison between

photographs of teen-age girls and boys. The facial pattern of young girls easily can be mistaken for that of women, while the facial pattern of the young boy displays a lack of maturity. An example of this is in the theater where young girls are often called upon to assume the roles of older women, while boys more often are in the gallery acting their age.

While there is still much to learn in cephalometry, a sufficient amount of research material now is available to recognize the present-day importance of correlating it with our photographs and models, and applying it to our clinical work. Cephalometry should not become a bible to be leaned on to the extent that the challenge to one's thinking is arrested, but, rather, it should act as a stimulus in aiding our corrective attempts in the difficult cases.

Although the Downs analysis is perhaps the most comprehensive method of appraisal, there are others which should interest all men who seek to become students of cephalometry. Notable among these is the work of Margolis in 1947[7] with his maxillofacial triangle which presents a great deal of similarity to the Downs analysis, but lacks the completeness thereof. Another method is that of Björk (1947 to 1951)[8] which offers the highest degree of perfection in a comparative analysis by a series of seven connected lines surrounding variable areas of growth, thus forming a configuration of angles and lines which denote the degree of facial prognathism. As in Wylie's assessment, Björk uses the anterior nasal spine which often becomes difficult to discern in headplates and must correlate lineal measurements with angulations, whereas the Downs analysis has a related line to the central ray of the x-ray tube and at the same time offers a relatively simple method of orienting head film and photograph.

In all our evaluations an engineer would try hard to sympathize with our attempts at accuracy, but would criticize the faith that is often placed in an interpretative analysis. Where they have tolerances of $\frac{1}{1000}$ of an inch, we must be satisfied with mean measurements that may err 2 and 3 mm. Measurements that are made on points other than the midsagittal plane increase the chance of error. Only in the dry skull is there any degree of accuracy, yet here, too, there is shrinkage that may result in errors of several millimeters.

Margolis* was the first to relate the axial inclination of the lower central incisors with the mandibular plane angle in lateral aspects. Later Tweed** developed a conception of the $90° \pm 5°$ extreme range of the position of the mandibular incisors to the mandibular plane which is measured with more accuracy in the head film. A cephalometric study of Tweed's relation of the lower border of the mandible to the Frankfort-horizontal also has a high degree of influence on the prognosis of a case.

It is apparent that incisors which are upright in the mandibular basal bone at a 90 degree angle with the lower border of the mandible are in a

*Salzmann, J. A.: Principles of Orthodontics, ed. 2, Philadelphia, 1950, J. B. Lippincott Company, p. 561.

**Salzmann, J. A.: Principles of Orthodontics, ed. 2, Philadelphia, 1950, J. B. Lippincott Company, p. 562.

position of mechanical advantage except in those cases where there are steep mandibular plane angles as related to the Frankfort-horizontal plane where the prognosis becomes unfavorable regardless of the angulation.

FUNCTIONAL ANALYSIS

There is little doubt in the minds of men who are engaged in the evaluation of cephalometric head films that we are in the early stages of an era that may open the door to an entirely new concept of orthodontic treatment. Brodie's growth investigation in 1941 of a group of normal occlusions in children from the ages of 3 months to 8 years demonstrated that separate areas of growth are so coordinated that any given point tends to travel on a straight line. This work has carried our research into the transitional dentition, but not into our average age of treatment and, as this investigation continues, we will find that there is much to learn in the growth ages of the permanent dentition that can be correlated closely to our cephalometric analysis.

Insofar as the functional aspect is concerned, we are just beginning to appreciate the complexities of this problem. Mandibular closure at first glance is nothing more than a study in physics: force versus resistance, the force being directed by the musculature attached to the mandible, and the resistance by the bolus of food. However, in the study of this relationship one becomes acutely aware of the complexities of musculature and the position of attachment thereof, and of the extent to which nature has extended to man an arrangement of facial and masticatory musculature that is the optimum in engineering principles of energy conservation. Here is found a truly amazing structure whose musculature exerts a rotating force upward, downward, forward, backward, or laterally, with no exact point of rotation being definable, but theoretically located in the neck of the condyle. The mandible apparently is suspended in a sling of musculature with the only point of consistent contact being maintained by the gliding action of the head of the condyle, and attaining complete contact only when the teeth are in occlusion.

There are two positions of the mandible that have attracted the attention of the investigators: (1) the centric occlusion, which is defined as that relationship which exists between the cusps and fossa of the teeth when the teeth are closed, and (2) centric relation, which is the relationship that exists between the condyle and fossa when the mandible is in rest position. Rest position is described by Thompson[9] as follows: "All functional movements of the mandible begin from the rest position where the musculature is in equilibrium, and the mandible returns to this position after function."

Early in 1932 Gosta Lindblöm[10] described the importance of the rest position in relation to centric position and the inadequate methods of securing correct mandibular position in cases requiring restorative dentistry. He recognized also that there were discrepancies between the physiologic and the physical rest positions as introduced by Planer, and the real and habitual central occlusion as introduced by himself.

It was not until Brodie's static studies were well advanced, that J. R. Thompson, using the same head films which were studied by Brodie, began one of the truly important studies of the age, namely, "Functional Analysis."

To orthodontists, prosthodontists, and restorative dentists, this work published in 1948 showed that it was impossible to change the position of occlusion to a line of opening beyond the true rest position.

As Thompson developed his thesis it became apparent that in some cases the path of closure of the mandible from a rest position to closure was guided distally by malpositioned teeth or cuspal interference. It is in these cephalometric head film studies that the orthodontist is able to discern pseudo closures and true closure, just as Thompson did. This is ably pointed out by J. Ford and W. Ford[11] who demonstrated the true scientific plane of approach in diagnosis of a distoclusion where headplate interpretations indicate a simple treatment plan using a bite plate.

A cephalometric functional diagnosis perhaps offers the greatest opportunity for research of any of the present fields of study. Ricketts[12] in his excellent work used the laminagraph to great advantage in disclosing mandibular movements, but it is primarily a research instrument which is unavailable to private practitioners and is limited in its scope.

Cephalometrics, on the other hand, will give an image of both the right and left sides of the mandible which easily can be traced separately for a functional analysis, or developed to a midsagittal plane for a static interpretation.

Ricketts' investigation into the dynamic aspects of the human temporomandibular articulation with morphologic as well as functional variations might well be correlated to the investigation of Moyers[13] who initiated electromyographic evaluation of the muscles of mastication, first in 1949 and again in 1950.

In the early investigation he discovered that there was a tonicity change that took place in the posterior fibers of the temporal muscles of Class II, Division 1 cases when they were corrected to normal occlusion. He also showed an electrical impulse variation in the temporal muscle during the transitional period of the deciduous dentition into the permanent dentition, from normal (deciduous dentition) to abnormal (transitional period), and then back to normal (permanent dentition), and stated that distoclusions which were corrected to neutroclusions would require a re-education of the muscle fibers if they were to develop and maintain a proper balance.

For many men, the conclusion of these experiments has brought a greater appreciation of the influence that Rogers[14] has exerted in his consideration of faulty muscular unbalance and its correction through muscular exercises.

Brodie,[15] in summarizing a discussion of the importance of the musculature, calls attention to the fact that there has been a strong tendency to restrict orthodontic considerations to the morphology of the bony face and view it as static, imploring the orthodontist to become more aware of the continuous interplay between muscular forces and bony structures.

In making a functional analysis it has been the custom in my office to use separating wires mesial to the lower left sixth year molar and between the central incisors as advocated by Adams[16] in 1940. This affords a clear two-point area of registration for the side of the mandible showing the least amount of distortion. Placement of these separating wires often must be moved to another location on the left side in the denture, because a large filling on the opposite side might obscure the registration of this marker. If it interferes with occlusion it is placed around the gingival of the lower sixth year molar or central incisor.

The possibility that we may recognize faulty muscular coordination through cephalometric tracings has resulted in an experimental study of twenty-eight cases in which each case has been functionally analyzed from a closed position to 31 mm. of opening between the incisors using the registration markers (separating wires) as points of superimposition. In this study a separate template tracing of the left side of the mandible in rest position was made for each case in which five pin holes were made in each tracing with the point of the calipers.

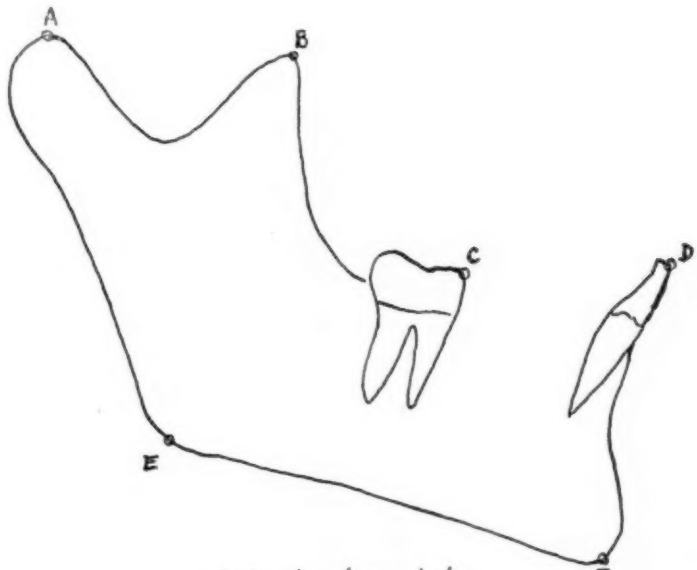


Plate V.

Point *A* in Plate V represents the highest point on the superior border of the left condyle. Point *B* represents the highest point of the left coronoid process. Point *C* represents the left mandibular sixth year molar. Point *D* represents the embrasure between the incisal edges of the lower central incisors. Point *E* represents the gonial angle. Point *F* represents the gnathion. Each template then was traced to a single matching skull tracing in either four or five separate positions of the mandible representing closed, rest, open 15 mm., 25 mm., and 31 mm. The pin-point registrations were connected so that any movement

could be discerned at any point of the mandible, and resulted in findings similar to those of Ricketts which are registered in Plate VI. Additional data are recorded in those openings greater than the rest position.

Varying degrees of curvature of incisal opening (Plate II) were found for the twenty-eight cases studied, and, with the exception of one (Plate VIII),

Plate VI.

there was but little that would differentiate one from the other. Opening from closed to rest position offered the greatest difference, while additional vertical opening is typical of that of Plate VI and Plate VII. Plate VIII presents an unusual path of closure in that when wax was placed between either the

anterior or the posterior teeth, the path of closure was on an even arc similar to that of Plate VI; but, in two separate rest position head films taken several weeks apart, the mandible is distal to the path of closure.

CONCLUSION

Cephalometrics has progressed to the point where it is no longer the toy of the research artist, but is a necessary adjunct to a complete and well-planned diagnosis. Advances in recent roentgenographic techniques have developed a method of recording on a single film the sharp outline of hard and soft tissues.

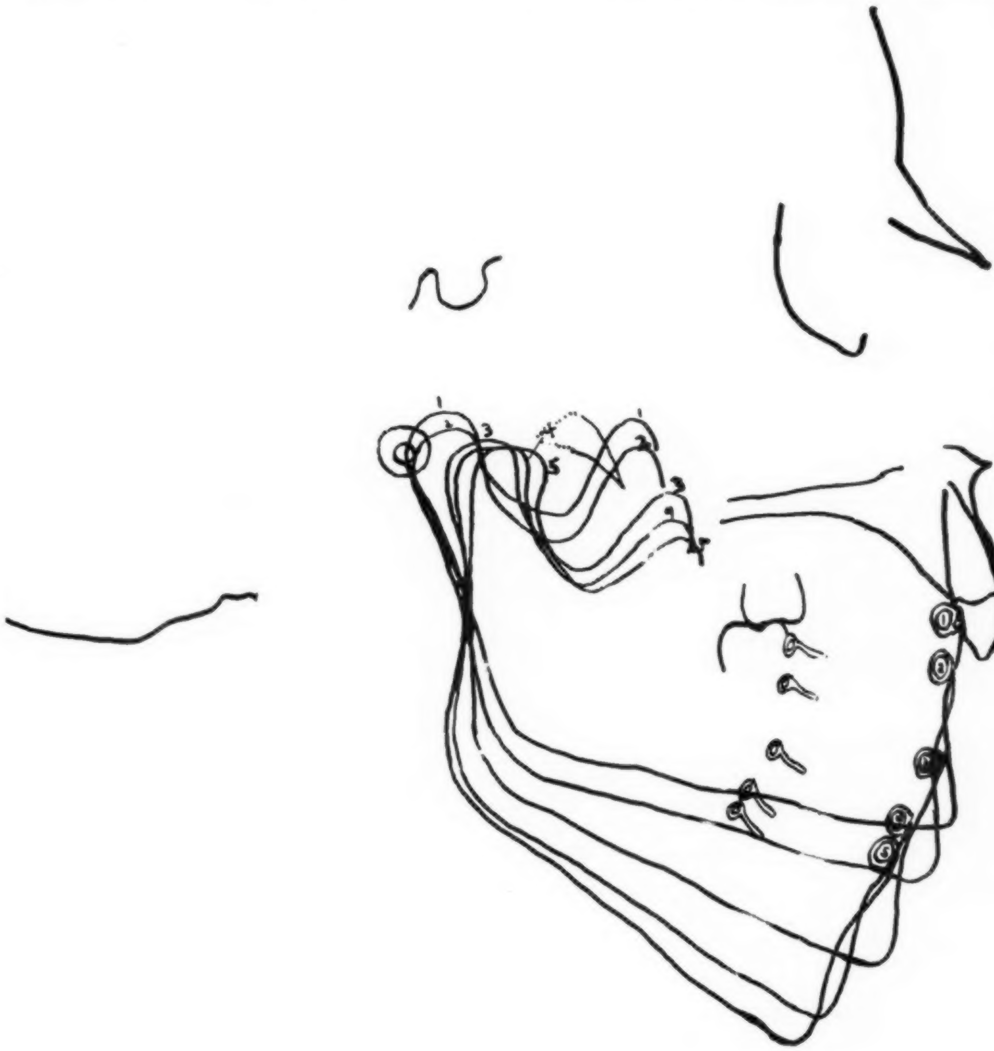


Plate VII.

Head films are not to be considered as the answer to all the problems, but as in the Downs, Björk, Margolis, Wylie, and other analyses, they offer a more positive method of comparison of areas of disproportion in treated and untreated cases than ever has been devised on the living skull.

The vertical height classification as presented offers a visual interpretation of the relationship of the lower face to the upper face and is adaptable to all of the anterior-posterior dysplasia classifications. In the small samples used in the combining of the three well-known landmarks, nasion, porion, and Bolton points, there is an indication of a consistent change in all of the relative planes as this angle increases or decreases.

Plate VIII.

Since the works of Thompson, a cephalometric functional analysis has become valuable and differentiating between the pseudo distoclusion cases and the true distoclusion cases, and it offers us a chance to discuss our orthodontic cases with colleagues and parents with a greater degree of assurance than ever before.

The tracings of function in Plate VIII, in departing from the normal, give rise to the belief that there is either a partial condylar interference, or that there is a compensated unbalance in the muscular tonicity. It is too early to speculate what will be found in subsequent head films, but the fact that headplates have been taken and this fact noted offers a more positive approach in the event a case does not follow the normal treatment pattern.

The orthodontist is always seeking answers that will aid in the favorable conclusion of the orthodontic case. Natural inquisitiveness will keep him forever intent on trying to penetrate the mysteries of the growth and mechanics of the human skull by making a static and functional analysis of serial head films, and it is in these repeated attempts that cephalometry will prove its value to all men who become familiar with its every use.

REFERENCES

1. Brodie, A. G.: On the Growth Pattern of the Human Head From the Third Month to the Eighth Year of Life, Am. J. Anat. **68**: 209-261, 1941.
2. Wylie, W.: Angle Orthodontist **17**: 99, 1947.
3. Riedel, R. A.: Notes and Laboratory Manual for Practical Cephalometry, manual used in University of Washington Post Graduate Seminar, p. 86, 1951.
4. Downs, W. B.: Variations in Facial Relations, Their Significance in Treatment and Prognosis, Am. J. Orthodontics **34**: 812-840, 1948.
5. Johnson, E. L.: Frankfort-Mandibular Plane Angle and Facial Pattern, Am. J. Orthodontics **36**: 516-533, 1950.
6. Petraites, B. J.: A Cephalometric Study of Excellent Occlusion and Class I Malocclusion of Children and Adults, Master of Science Thesis, University of Washington, 1951.
7. Margolis, H. I.: A Basic Facial Pattern and Its Application in Clinical Orthodontics. I. The Maxillofacial Triangle, Am. J. Orthodontics **33**: 631-641, 1947.
8. Björk, A.: The Nature of Facial Prognathism and Its Relation to Normal Occlusion of the Teeth, Am. J. Orthodontics **37**: 106, 1951.
9. Thompson, J. R.: Oral and Environmental Factors as Etiological Factors in Malocclusion of the Teeth, Am. J. Orthodontics **35**: 33-53, 1949; The Rest Position of the Mandible and Its Analysis and Correction of Malocclusion, Angle Orthodontist **19**: 162-187, 1949.
10. Lindblöm, Gosta: Technic of Roentgen Photographic Registration of the Different Condyle Positions in the Tempomandibular Joint, Dental Cosmos **78**: 1229, 1936.
11. Ford, J. W., and Ford, W. F.: Cephalometric Appraisal of a Mandibular Displacement Case, Am. J. Orthodontics **36**: 222-228, 1950.
12. Ricketts, R. M.: Variations of the Temporomandibular Joint as Revealed by Cephalometric Laminagraphy, Am. J. Orthodontics **36**: 877-897, 1950.
13. Moyers, R. E.: Temporomandibular Muscle Contraction: Patterns in Angle, Class II, Division 1 Malocclusions, Am. J. Orthodontics **35**: 837-855, 1949; **36**: 481-514, 1950.
14. Rogers, A. P.: A Restatement of the Myofunctional Concept in Orthodontics, Am. J. Orthodontics **36**: 845-855, 1950.
15. Brodie, A. G.: Anatomy and Physiology of Head and Neck Musculature, Am. J. Orthodontics **36**: 831, 1950.
16. Adams, J. W.: Correction of Error in Cephalometric Roentgenograms, Angle Orthodontist **10**: 9, 1940.

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INTERDENTAL SEPARATION IN SUBCLINICAL ACROMEGALY CAUSED BY SINUSITIS

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THE dentist encounters numerous instances of separation of teeth not caused by drift, for which explanation is difficult. A dentist, Dr. A. M. Corn, first aroused my interest in the problem when he referred a patient showing interdental separation (Case 1) with a tentative diagnosis of early acromegaly.[1] Subsequently, I observed many patients showing separation of teeth. Almost without exception, these patients had many symptoms of systemic infection.

This article presents seven patients whose pituitary gland was probably stimulated by toxins from chronic sinusitis, resulting in mild or subclinical acromegaly and widening of the interdental space.

The diagnosis of chronic sinusitis is made by its numerous symptoms[2] and signs.[3] Symptoms include constant sniffing and hacking in the absence of an admitted cold, frequent colds[4] and coughs,[5] morning headache, rheumatic pains,[6] ill effects of prolonged recumbency,[7] anorexia for breakfast, dark circles beneath eyes,[8] puffs beside nose, and tenderness of the sinuses to palpation (Fig. 8, *B*) and to percussion. The degree of this tenderness is a reliable sign of the amount of purulent tension therein.[3] Cervical adenitis (Fig. 8, *C*) is uniformly present.

The diagnosis of acromegaly is easily made in frank cases. Acromegaly is the only disease which causes acral enlargement and "whopper jaw," with consequent separation of teeth (Fig. 1).[9] Familiar examples of acromegaly are the former heavyweight boxing champion, Primo Carnera, and the French wrestler, Maurice Tillet, known as The Angel. Although the mandible is usually prominent, there is often enlargement also of the maxilla, supraorbital ridges, and nasal sinuses.

In mild or subclinical cases of acromegaly, only slight enlargement of the jaw takes place, accompanied by a correspondingly slight separation of teeth. Without simultaneous enlargement of the hands and feet, the diagnosis remains in doubt. In four of the seven cases presented, both interdental separation and acral enlargement occurred. In the other three, subclinical acromegaly was suspected because there was separation of teeth not accounted for by drift, presumably caused by enlargement of the jaw. Furthermore, an active chronic systemic infection was present while the teeth were separating.

Regarding etiology, acromegaly may be produced by conditions which stimulate acidophilic cells in the anterior portion of the pituitary gland, such as tumor, emotional shock, and infection.[10] Tumor and infection are the common incitants of the pituitary resulting in acromegaly. The role of infection requires emphasis.

Infection.—If one considers the subclinical or abortive cases of acromegaly, infection is probably a more common stimulant of the pituitary gland than is tumor.[9-12] Goldzieher[12] properly points out that, although textbooks contain a great deal of information about tumors of the pituitary, tumors represent only a small percentage of the whole clinical material. Both Goldzieher and Engelbach[13] emphasize the prolonged and chronic infections as stimulants of pituitary disease.

Chronic sinusitis is a common source of continuing systemic infection. Mark[14] described his own acromegaly and the many annoying symptoms of chronic sinusitis. Two sphenoid sinuses lie immediately below the pituitary gland. Pickworth[15] traced diplococci from the sphenoid through the periosteum, dural lining of the pituitary fossa, and capsule of the pituitary gland to the gland itself. Watson-Williams illustrated this relationship in his textbook.[16] However, toxins of bacteria, rather than the organisms themselves, are the usual pathogenic agents.[17] Toxins may invade the pituitary in two ways: either directly from the sphenoid sinuses, or indirectly through the general circulation by first penetrating cervical nodes and then entering the thoracic duct and heart.

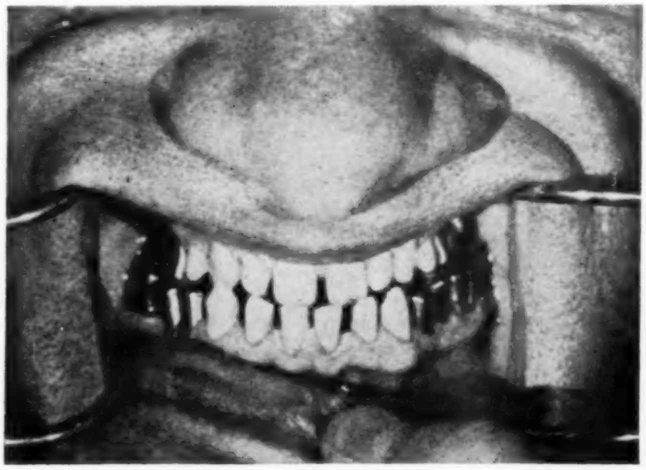

Fig. 1.—Separation of all teeth in man, aged 30, with acromegaly. (From Rosenthal: U. S. Vet. Bur. M. Bull., December, 1926.

Geographic Influence.—It probably was not fortuitous that several patients, in good health while residing in inland climates, should develop active sinusitis and systemic symptoms on the coast, following which there occurred enlargement of feet and jaws and interdental separation. The first patient moved from an inland elevation to the East Coast, only to develop active sinusitis and systemic symptoms, diastema and acral enlargement. The second patient moved from Oklahoma to the upper West Coast; after three years an active sinusitis preceded enlargement of jaws and diastema. Patients 3 and 4 lived in upper West Coast areas and each had a troublesome sinusitis, followed by diastema and acral enlargement. The fifth patient, moving from

Utah to the West Coast, developed nausea from sinusitis and an increasing diastema. Patient 6 lived in Mississippi until four years ago, when she moved to the West Coast; separation of teeth and acral enlargement were noted in the past two years during a period of active pansinusitis. Patient 7 lived for many years on the West Coast, during which time he had a severe sinusitis and separation of all teeth.

Seven examples of separation of teeth probably secondary to stimulation of the pituitary by toxins from chronic sinusitis follow:

CASE 1.—A woman, aged 24, was referred by Arthur M. Corn, D.D.S., with a tentative diagnosis of beginning acromegaly.[1] Dr. Corn had been consulted because in the past year the patient had noted an increasing and embarrassing separation of lower central incisors.

Fig. 2.—Diastema resembling missing tooth in subclinical acromegaly. (Case 1.)

This measured 7.4 mm. (Fig. 2). During the same period there also appeared an enlargement of the knuckles, finger joints, and feet, the latter crowding her shoes so that a callus formed lateral to the left fifth metatarsal, similar to that of Case 4 (Fig. 5*B*).

History revealed that the patient had been well in Altoona, Pa., situated at an altitude of 1,180 feet, before moving to New York City four years ago. During these four years she noted anorexia for breakfast. In the past year new symptoms developed, consisting of frontal and parietal headaches, especially on late sleeping, constant clearing of the throat, occasional blurring of vision, dyspnea upon exertion, and occasional precordial stabs.

Physical examination: Eyes show slight photophobia and narrowing of visual fields; eye grounds are negative. Tonsils are small; no pus exudes on pressure. Lymph nodes: slight submaxillary and cervical adenitis, bilateral. Sinuses: mild left frontal tenderness to palpation; marked bilateral ethmoid tenderness; mild bilateral antral tenderness. Calluses are noted external to fifth metatarsals.

Roentgenograms were taken of skull, jaws, and sinuses. Skull: negative for changes in sella turcica, ruling out tumor. Jaws: separation of lower central incisors with hypertrophy of alveolus between them; mild protraction or prognathism of maxillae. Sinuses: diminished aeration in both ethmoids and the cellular walls are thickened; there is a thickened mucous membrane in the left antrum; sphenoid sinuses are rather large.

Treatment was directed to the sinuses, consisting of the use of nose drops twice daily, hot wet towels to the face twice daily, elevation of the head during recumbency, avoidance of chilling, and other conservative therapy. After four months her headaches and morning anorexia had greatly improved, her blurred vision had lessened, but the interproximal space between the lower central incisors had increased slightly from 7.4 to 7.8 mm. However, in the following year there was no further separation.

CASE 2.—A 30-year-old woman observed separation of upper and lower teeth in the past year (Fig. 3). A considerable enlargement of her jaw had been noted by the patient and her parents.

History revealed that she resided in Oklahoma until three years ago, when she moved to the upper West Coast, at which time her sinusitis became more troublesome. She had circles under her eyes since childhood. In the past year she noted frequent headaches, pressure back of eyes, asthenopia, and a sensitivity to cold and hot food in her upper back teeth for which dental consultation and roentgenograms were unrevealing.

Physical examination shows separation of both upper and lower teeth (Fig. 3), malocclusion, periodontoclasia, and recession of gingivae. There is no loss of teeth in the upper jaw, ruling out drift as a cause for dental separation. Large, square jaw is present. The patient sniffs and hacks at frequent intervals in the absence of an admitted cold. She exhibits dark circles and puffs under her eyes and puffs beside her nose. Sinusitis is further indicated by tenderness to palpation of right frontal sinus, ethmoids, and antra. Tenderness of eyeballs suggests bilateral sphenoiditis. There is also a mild bilateral cervical adenitis and a mild right submaxillary adenitis.

Fig. 3.

Fig. 4.

Fig. 3.—Separation of teeth and square jaw of subclinical acromegaly. Note also circles under eyes and puffs beside nose of chronic sinusitis. (Case 2.)

Fig. 4.—Diastema in subclinical acromegaly. Upper teeth were similarly spaced before extraction. Note circles under eyes and puffs beside nose. (Case 3.)

CASE 3.—A woman, aged 56, had a slowly increasing separation of teeth of both jaws over many years. Upper teeth were extracted because of periodontoclasia, which now affects lower teeth (Fig. 4).

History reveals that the patient had lived near Seattle during the past twenty years. At age 22 her shoe size was 5½; this has increased slowly to size 7½ at present.

She had had an active chronic sinusitis of many years' duration, symptoms being puffy eyes (without urinary tract or cardiac involvement), lack of appetite for breakfast, rheumatic pains, and inability to take cold food because of shooting pain into her forehead despite an upper plate.

Physical examination shows right frontal and antral tenderness and a left sphenoiditis indicated by tender left eyeball and left parietal tenderness. There are circles under her eyes and bilateral cervical adenitis secondary to sinusitis.

Fig. 5*A*.—Separation of teeth and malocclusion caused by enlarging mandible.

Fig. 5*B*.—Same patient as in Fig. 5*A*, showing callus lateral to base of little toe due to crowding of foot. (Case 4.)

CASE 4.—A woman, aged 26, a resident in a foggy West Coast area, was unaware of her widened interdental spaces (Figs. 5*A* and 5*B*) until it was called to her attention. Her father, who had not seen her for several years, commented on a swelling of her face.

Tonsillectomy was performed at age 10. Her right upper third molar and left lower second and third molars were extracted about five years ago. However, interdental separation was not caused by drift, since diastema involved all teeth (Figs. 5*A* and 5*B*).

History of acral enlargement was obtained. In the past two years her wedding rings, which previously had slipped off easily, could no longer be removed. Her shoe size increased from 7½ five years ago to 8½ at present. Widening of both feet could be presumed from calluses, lateral to the base of both little toes, present in the past year (Fig. 5*B*).

Sinusitis was apparently present for many years. Symptoms included shifting nasal obstruction, right parietal soreness on combing hair (indicating right sphenoiditis), recurring cough and rheumatic pains, anorexia for breakfast, and frequent headaches upon arising.

Physical examination reveals constant sniffing and hacking in the absence of an admitted cold. Sinus tenderness is present in right frontal, ethmoid, and antrum. There is tenderness of both eyeballs, especially right, indicating sphenoiditis. Tenderness of right parietal area is present, indicating right sphenoiditis. Right submaxillary adenitis, secondary to right antritis, is present. There is also right cervical adenitis.

CASE 5.—The patient, a 29-year-old woman, believes her teeth were always spaced; her lower central incisors have been separating further in the past four years (Fig. 6). She states her father had separated teeth.

History reveals residence in Utah until age 12. From age 13 to age 26 she lived near Los Angeles. In the past three years she lived in Oregon and Washington. She had rheumatic fever at age 8, which lasted several months, and she took digitalis from age 8 to 12. There has been no change in shoe size since age 16.

Fig. 6.

Fig. 7.

Fig. 6.—Interdental separation. Note ridging of tongue from pressure into spaced teeth. (Case 5.)

Fig. 7.—Interdental separation in upper jaw. (Case 6.)

She has had a fetor oris and anorexia upon arising from years and had eaten no breakfast in the past five months, all symptoms of chronic sinusitis.

Physical examination reveals moderate tenderness of all sinuses and cervical adenitis. All teeth in the upper jaw are spaced; in the mandible diastema is seen mainly between the central incisors, but also between the left cuspid and incisors. Her tongue is indented from pressure into spaced teeth (Fig. 6).

A.

B.

C.

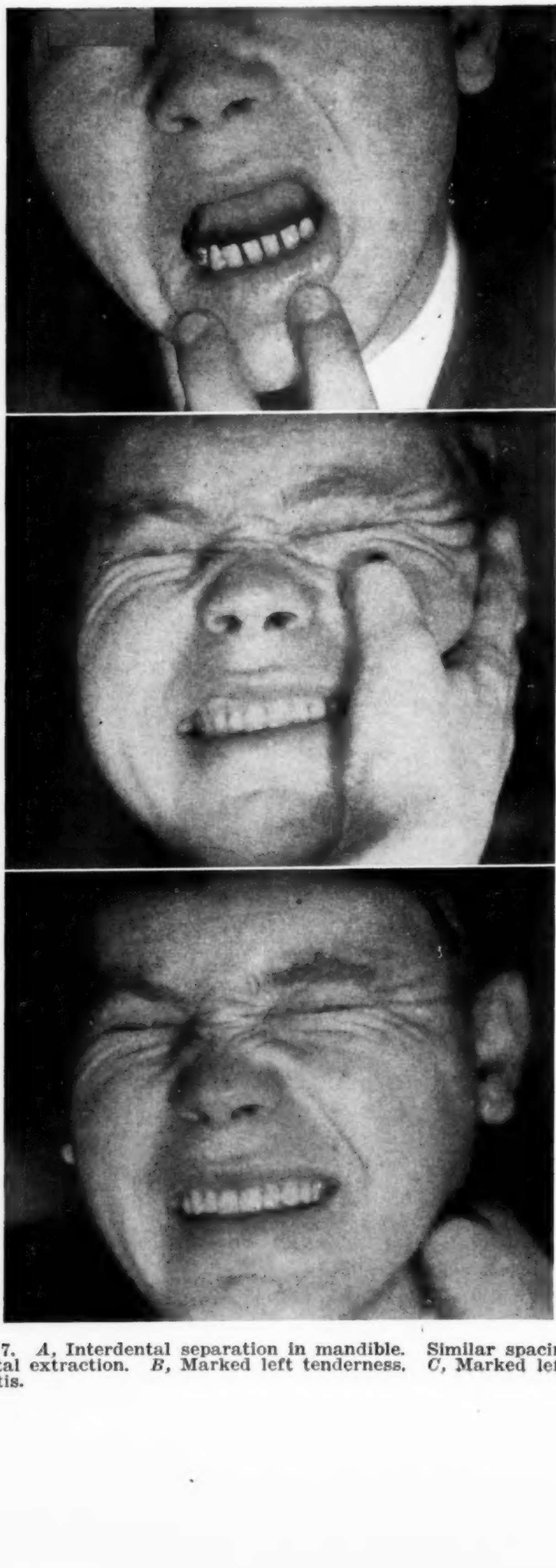

Fig. 8.—Case 7. *A*, Interdental separation in mandible. Similar spacing occurred in upper jaw before dental extraction. *B*, Marked left tenderness. *C*, Marked left cervical adenitis secondary to sinusitis.

CASE 6.—A young woman, aged 19, noted separation of teeth (Fig. 7), mainly in the upper jaw, during the past two years. In the past year her shoe size increased from 6 to 8½. She left Mississippi four years ago to come to the West Coast.

Physical examination reveals an active pansinusitis and moderate bilateral cervical adenitis. No teeth are missing in upper jaw, but there is a uniform spacing between all teeth. Lower teeth are barely involved.

CASE 7.—A 29-year-old man noted separation of upper teeth at age 20; because of caries and periodontoclasia, all upper teeth were removed at age 22. A similar spacing of lower teeth (Fig. 8) was observed in the following seven years.

History reveals residence on Washington coast since age 9. The patient had many sore throats, frequent rheumatic pains, and numerous symptoms of chronic sinusitis, including frequent colds, left parietal tenderness when combing hair, and pain into eyes and forehead, despite upper dental plate, when taking cold food. There has been no change in shoe size for several years. Two years ago several lower molars were extracted because of severe caries.

Physical examination reveals a severe pansinusitis (Fig. 8, *B*). Infection of the sphenoid sinuses, particularly on the left, is suggested by severe left eyeball tenderness associated with left parietal tenderness to palpation. Tonsils are small and not especially injected. Cervical nodes are very tender (Fig. 8, *C*). Seven remaining teeth in the lower jaw show separation.

DISCUSSION

It is the dentist, rather than the physician, who may be first consulted for interdental separation. In suspected acromegaly a few questions directed by the dentist often will reveal many symptoms of systemic infection. The dentist will do well to refer these toxic individuals to their physician. By mutual cooperation, continuing interdental spacing and systemic disease may be halted, as in Case 1.

While frank acromegaly is rare, subclinical cases are legion. Separation of teeth is an early clue.[18-20] Macneil[21] states, "The alert dentist may be the first to suspect acromegaly because spacing of the lower teeth is regarded as an early diagnostic sign." Dental separation was noted in the seven patients presented. Inquiry as to change in shoe or glove size aids in determining acral enlargement, which is present in four of our seven patients.

No instance has been found in the literature on acromegaly similar to Case 1, where midline diastema progressed simultaneously with acral enlargement. Almost invariably in clinical acromegaly as the jaws enlarge there is separation of all (Fig. 1) or most teeth.[13, 22-24]

Midline separation of teeth is commonly seen without acral enlargement; one can only conjecture on its etiology. President Franklin D. Roosevelt had a diastema of his lower central incisors (similar to Case 1) for which he wore a single-tooth removable bridge, and without which he would whistle on certain words.[25] It is well known that the late President had an active chronic sinusitis for which he was treated almost daily during his tenure in the White House.[25] Toxins from sinusitis may have stimulated his pituitary gland, resulting in midline enlargement of the jaw and interdental separation.

CONCLUSIONS

1. Separation of teeth, not caused by drift, is reported in seven patients. Acral enlargement was present in four; in two of these, calluses formed lateral

to the fifth metatarsals. These four patients had subclinical acromegaly. The remaining three patients had enlarged jaws, but without acral involvement, and probably represented milder forms of the same process.

2. Chronic toxemia, rather than tumor, is the most common stimulant of the anterior pituitary gland, hypersecretion of which is responsible for acromegaly and separation of teeth.

3. Chronic sinusitis is probably the most frequent source of toxemia resulting in enlargement of the jaw and consequent interdental separation. Both chronic sinusitis and cervical adenitis were present in all seven patients.

4. All seven patients resided in a northern coastal climate at the time systemic symptoms developed and interdental separation was observed.

5. In unexplained progressive separation of teeth, clinical or subclinical acromegaly should be suspected. Cooperation between dentist and physician may be advantageous to the patient. The physician can aid in diagnosing and treating chronic systemic infection, particularly ubiquitous sinusitis, responsible for stimulating the pituitary gland and producing subclinical acromegaly and separation of teeth. In one patient followed for sixteen months, separation of the lower incisors halted and many symptoms of sinusitis ceased soon after treatment of her chronic sinusitis.

REFERENCES

1. Corn, A. M., and Brown, E. E.: Oral Manifestations of Systemic Disease in an Acromegaly Case, J. D. Soc. New York **9**: 61-65, 1943.
2. Brown, E. E.: Fifty Symptoms of Chronic Sinusitis in Children With Differential Diagnosis of Each Symptom, Arch. Pediat. **67**: 503, 1950, and **67**: 553, 1950.
3. Brown, E. E., and Wasson, V. P.: Clinical Diagnosis of Chronic Sinusitis, Arch. Pediat. **59**: 723-734, 1942.
4. Brown, E. E.: Common Cold Not Caused by Virus, Northwest Med. **44**: 39-42, 1945.
5. Brown, E. E.: Recurring and Chronic Cough in Children; Role of Sinusitis, Northwest Med. **47**: 435, 1948.
6. Brown, E. E.: Cause of Rheumatic Fever—Chronic Sinusitis, Arch. Pediat. **68**: 565, 1951.
7. Brown, E. E.: Ill Effects of Prolonged Recumbency in Paranasal Sinusitis, Arch. Pediat. **59**: 546-553, 1942.
8. Brown, E. E.: Puffiness Under Eyes in Children, Queries and Minor Notes, J. A. M. A. **141**: 428, 1949.
9. Knaggs, R. L.: Acromegaly, Brit. J. Surg. **23**: 69-109, 1935.
10. Osler, W.: Principles and Practice of Medicine, ed. 13, New York, 1938, D. Appleton-Century Company, Inc., p. 1134.
11. Perla, D., and Marmorston, J.: Natural Resistance and Clinical Medicine, Boston, 1941, Little, Brown & Company, p. 567.
12. Goldzieher, M. A.: Diagnostic Problems Involving the Pituitary, J. Pediat. **8**: 397-399, 1936.
13. Engelbach, W.: Endocrine Medicine, Springfield, Ill., 1932, Charles C Thomas, vol. 2, p. 457; vol. 3, p. 544.
14. Mark, L. P.: Apologia of an Acromegalic, Med. Press and Circular, Oct. 5 and 12, 1927.
15. Pickworth, F. A.: Organisms in Chronic Bone Infections of the Sphenoid, Proc. Roy. Soc. Med. **27**: 1509, 1934.
16. Watson-Williams, P.: Chronic Nasal Sinusitis and Its Relation to General Medicine, New York, 1930, William Wood & Company, p. 20.
17. Brown, E. E.: Focal Infection (To be published).
18. Comroe, B. I.: Internal Medicine in Dental Practice, ed. 2, Philadelphia, 1942, Lea & Febiger, p. 218.
19. Wolf, W.: Oral Manifestations of Endocrine Dysfunction, in Miller, S. C.: Oral Diagnosis and Treatment, ed. 2, Toronto, 1946, The Blakiston Company, p. 640.

20. Schour, I.: Endocrine and Teeth, J. A. D. A. **21:** 322, 1934.
21. Macneil, W. H.: The Relation of the Endocrines to Dental Development and Oral Health, J. Canad. D. A. **15:** 530, 1949.
22. Rosenthal, I. H.: Malocclusion Resulting from Acromegaly, U. S. Vet. Bur. M. Bull. **2:** 1168, 1926.
23. Jelliffe, S. E., and White, W. A.: Diseases of the Nervous System, Philadelphia, 1935, Lea & Febiger, p. 332.
24. Korkhaus, Gustav: The Changes in the Form of the Jaws and in the Position of the Teeth Produced by Acromegaly, INT. J. ORTHODONTIA **19:** 160, 1933.
25. Tully, Grace G.: Stories and Anecdotes about F. D. R., My Boss, Ladies' Home Journal, July, 1949, p. 46.

NORMAL VARIATION AND ITS BEARING ON THE USE OF CEPHALOMETRIC RADIOGRAPHS IN ORTHODONTIC DIAGNOSIS*

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The appraisal of the abnormal can succeed only in proportion to our ability to identify the range or limits of normal variation. This basic fact applies not only to the field of orthodontics, but to all phases of medical science.

The purpose of this article is to present results of a study on the range of variations in the dentofacial complex of individuals with normal occlusion from radiographic projections of the head in the sagittal plane. These radiographs are obtained with the aid of the Broadbent-Bolton cephalostat[1] and the enlargement inherent in a radiographic projection is standardized by keeping the focus-to-object distance constant, following Pacini.[2]

It must be stated that the three projections which are needed for the mathematical reconstruction of an object (the dentofacial complex), only two are furnished by the cephalometric radiographic technique. Of these two projections, only the sagittal is used in this and most other studies, because projections of the face in the sagittal plane are of particular importance to the diagnosis of bite anomalies. Previous studies (Schwarz,[3] Korkhaus,[4] De Coster,[5] Margolis,[6] Downs,[7] and Björk[8]) actually have resulted in a number of different methods to determine the relationship and interrelationship between dentition, face, and skull. This common aim is influenced by the work of Van Loon[9] who was a pioneer in applying cephalometric studies to orthodontics. He pointed out that a need existed to determine the relationship between dentition and head in order to clarify and improve the diagnosis of orthodontic disorders.

Van Loon's work constituted a basic step in the evolution of orthodontic thinking after the promulgation of the Angle classification, and became an impetus toward the development of new approaches in diagnosis and treatment. The introduction radiographic technique greatly enhanced the scope of the new trend as evidenced by the work of the aforementioned authors. Their endeavors, furthermore, have resulted in attempts to reach an understanding of the complexity which the normal invariably presents from studying cephalometric radiographs. Yet, the extent of the variation which is encountered in the normal has not always been stressed sufficiently or it has been obscured by selective sampling. Wylie[10] recognized the importance of variation and stated that "there is no such single entity as a 'normal' facial pattern, and that dentofacial anomalies are in a large measure occasioned by a random combination of facial parts, no one of which is abnormal in size when taken by itself, but each one of which may fit badly with the other parts to produce a condition which may be called dysplasia."

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In order to study the variations which occur in the normal dentofacial complex, a satisfactory sample has to be gathered. A precise interpretation of the word "normal" is needed, however, prior to the selection of individuals for study. The clinically acceptable definition of normal in orthodontics—an individual optimum of function (Andresen[11])—is not suitable for this purpose. This concept varies by implication from individual to individual and lacks the definitiveness necessary for a group study.

For the present investigation, only anatomic criteria were used. Since tooth position and occlusion are major criteria for assessment of normality in daily practice, they were used to determine the normality of the sample. Individuals were selected on the basis of excellent anatomic tooth position and occlusion with only the slightest deviations from the generally accepted ideal.

Of the methods available for the analysis of sagittal cephalometric radiographs, the mesh diagram, first described by D'Arcy Thompson[12] and applied to orthodontics by De Coster, furnishes the most useful means for evaluation of proportionate differences. De Coster's original mesh diagram has a number of shortcomings, however, which make its use for this purpose undesirable. His mesh is oriented on the Frankfort-horizontal line, which cannot be determined accurately on radiographs. The soft tissues allow appreciable movement of the head in the cephalostat and thereby cause variations in the position of shadows cast by the ear rods. Furthermore, the orbital point, orbitale, cannot be located with pin-point accuracy on radiographs. This may affect the construction of De Coster's mesh. The existence of this source of error is confirmed by Björk in his study of the reliability of orientation points in radiographs. Utilization of the soft tissue chin point in the construction of De Coster's mesh diagram likewise introduces additional errors. The great number of horizontal lines further complicates its use. In order to overcome these shortcomings a new mesh has been developed, determined by the skull base, the lowest border of the bony chin, and a minimum number of rectangles, in order to eliminate technical errors and to simplify the interpretation of roentgenographs.

For the present study, cephalometric radiographs in the sagittal projection were taken of fifty girls aged 19.73 ± 1.38 years, all of whom had normal anatomic occlusion. The ethnic origin of this group was predominantly European white, and it is a fair representation of the average American girl in this respect. Tracings of the radiographs were made on Kodapak cellophane sleeves, on which a number of anatomic landmarks were consequently marked. The choice of the landmarks and the determination of their location were guided by the usual procedure followed in anthropometry (Martin,[13] Salzmann,[14] and others), except for porion and orbitale.

Porion cannot be located on radiographs and the center of the shadows cast by the ear rods has been utilized instead. The relationship of this ear point to the dentofacial pattern is subject to considerable variation since the patient can move the head slightly in the cephalostat, as was mentioned previously. In the present study, the skin point was used for orbitale, recorded on the radiograph with the aid of a metal wire at the lowest point of the bony orbit, located by palpation.

Nine additional points were marked on the tracings, namely: the most posterior point on the curved lateral border of the orbit; the tip of the pterygomaxillary fissure; the lowest point of the projection of the zygomatic processes; the apices and incisal edges of maxillary and mandibular central incisors; the tip of the mesiobuccal cusp of the maxillary M_1; the lowest and most anterior point on the curvature of the bony chin between pogonion and gnathion or the chin point.

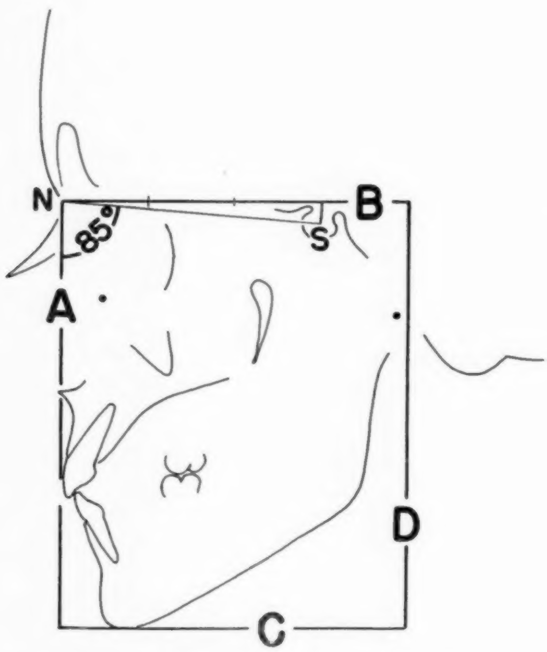

Fig. 1.—The construction of the mesh diagram.

After indicating these landmarks, a mesh was constructed on each tracing in the following manner:

Construction of the Outside Square (Fig. 1)

1. Determine the mid-point of sella turcica (*S*) and locate nasion (*N*).

2. Draw a line from sella turcica to nasion (*S-N*).

3. Draw line *A* 85 degrees to line *S-N* (85 degrees is an approximate angle of prognathism for white people).

4. Draw two lines perpendicular to *A*, through nasion and the lowest point of the bony chin (*B-C*).

5. In order to draw the last line *D* of the basic rectangle, the distance *S-N* is transferred to *B* and divided into three equal parts. The length of one part is added to the occipital end of line *B* and subsequently a point is obtained.

6. The last line of the basic rectangle, *D*, then is drawn through the point just determined, perpendicular to *B* and, consequently, to *C* also.

Construction of the Mesh

7. Three lines are drawn perpendicular to *B* and *C* through points already marked on *B* (see No. 5), dividing the rectangle into four equal parts.

8. *A* and *D* also are subdivided into four equal parts and again four lines are drawn perpendicular to *A* and *D* through these points.

9. A mesh of sixteen rectangles now will result.

Upon completion of the mesh, three landmarks have been added, namely, two points of intersection of the palate and one of the mandible with the respective vertical mesh lines. These points are helpful in approximating palate shape and contour of the mandible. In the present study the location of each selected point in both the vertical and horizontal directions then was measured with a sliding caliper equipped with a vernier scale to allow readings of 0.1 mm. The location of the chin point and intersection of the palate and mandible with vertical mesh lines could be determined only in the horizontal and vertical directions, respectively. In addition, the length and breadth of one rectangle were measured on each tracing. A statistical analysis of the multitude of measurements was made in order to arrive at the average location (mean) of the landmarks, and the spread of the individual observations around the means (standard deviation). Actual figures are not reported. In addition the proportionate position of the landmarks in the individual tracings was determined by calculating the position of these landmarks as a percentage of the horizontal and vertical dimensions of the mesh rectangles. These findings are presented in Table I.

TABLE I. THE POSITION OF CERTAIN ANATOMIC LANDMARKS AND POINTS IN THE RECTANGLES OF A MESH DIAGRAM

	HORIZTONTAL			VERTICAL		
	MEAN	STANDARD ERROR	STANDARD DEVIATION	MEAN	STANDARD ERROR	STANDARD DEVIATION
Chin point	48.32	3.60	25.43			
Mandible intersection				48.98	1.68	11.90
Gonion	42.72	2.94	20.77	24.27	2.02	14.27
Apex mandibular	66.78	0.85	6.01	66.33	0.36	2.55
Infradental point	24.36	2.37	16.77	2.82	0.75	5.25
Incisal edge, mandibular I_1	17.30	2.03	14.39	32.45	0.91	6.41
Incisal edge, maxillary I_1	6.65	1.30	9.16	20.77	0.88	6.21
Tip mesiobuccal cusp, maxillary M_1	33.73	2.29	16.18	43.39	0.76	5.40
Posterior palatal intersection				27.75	1.04	6.22
Anterior palatal intersection				11.31	1.17	8.24
Apex maxillary I_1	62.45	1.86	13.20	7.14	1.71	12.12
Prosthion	4.51	1.00	7.07	61.20	0.94	6.67
Anterior nasal spine	0.92	0.54	3.79	20.59	1.23	8.68
Pterygomaxillary fissure	20.04	1.81	12.83	40.89	1.31	9.28
Zygomatic process	22.00	1.60	11.32	35.29	1.05	7.43
Ear point	88.51	2.24	15.70	91.43	1.70	11.93
Infraorbital point	47.23	1.50	10.64	7.65	1.13	8.01
Orbital margin	28.00	1.23	8.72	51.53	0.31	2.16

The figures indicate the position of the landmarks or points in terms of a proportionate distance from the mesh line which is used as the basis of reference. The line selected is in all cases to the left of the point, or below it.

An average profile tracing then was made, based on the mean values of mesh size and landmark location (Fig. 2). The area of variation for each point in its own rectangle has been illustrated by constructing ovals. The standard

deviation levels were used for the determination of the horizontal and vertical axes of these ovals, and the numerical values of the standard deviations therefore control the shape of the ovals from near circles to narrow ellipses.

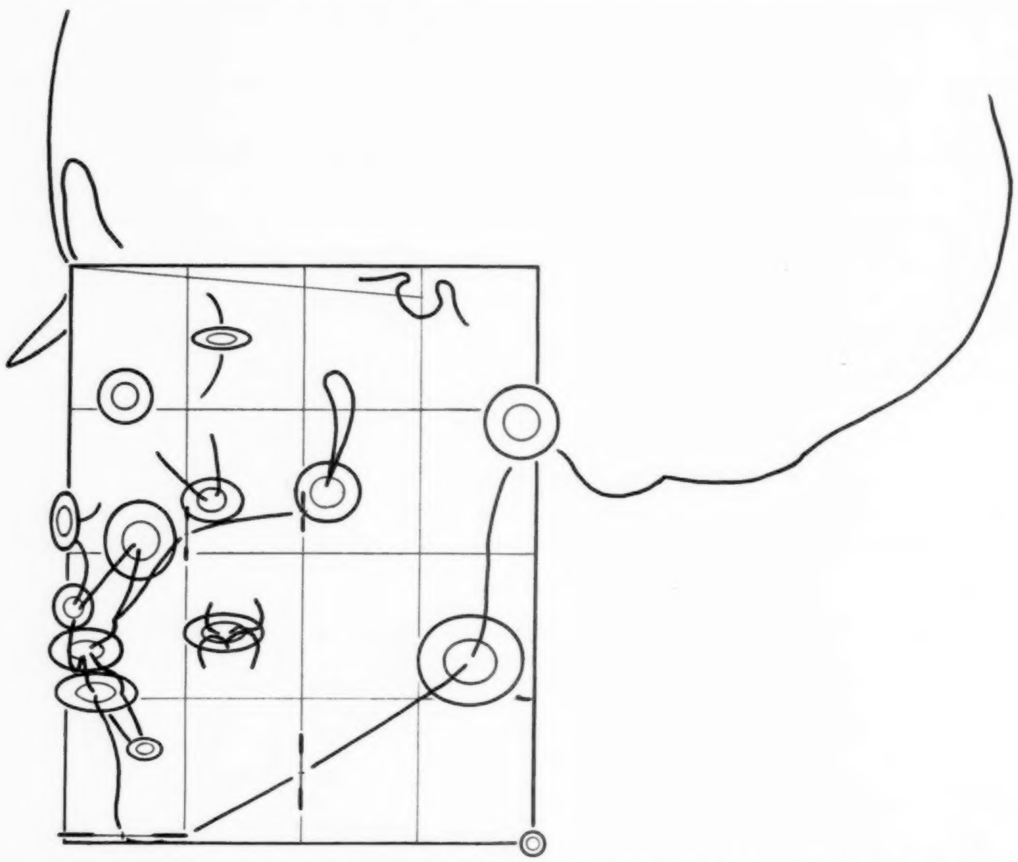

Fig. 2.—The average facial pattern. The concentric ovals show the spread of the individual measurements around the means at the one and two standard deviation limits.

Since our sample consists entirely of normal individuals, the one standard deviation limit cannot be accepted for the designation of the degree of normal variation. The extent of normal variation in reality is determined by the full range of observations, or else by the three standard deviation limits. In the present study, only values for one and two standard deviations have been used to construct the concentric ovals shown in Fig. 2. The two standard deviation limits were considered satisfactory because they incorporate 95 per cent of our sample, assuming that the distributions for the different observations are not skewed.

The extensive range of variations in the profiles of these fifty girls with normal occlusion is clearly indicated by the relatively large size of most ovals. The differences in size and shape of the ovals furthermore indicate a certain lack of interdependence between the landmarks. The degree of variation increases in general with the distance of the landmark from the basic orientation lines in either vertical or horizontal direction. The basic orientation lines are

the line nasion-sella turcica, and the lines *B* and *C* which are determined by nasion and the lowest point of the bony chin. Gonion and chin point, for instance, exhibit a larger variability in horizontal direction compared to other landmarks, and are farthest removed from the line *S-N*. No general application of this contention can be made because the apex of mandibular I_1 shows a very small range of variation in the horizontal direction and is at a similar distance from the orientation line *S-N* compared to gonion. The apex of mandibular I_1, furthermore, has a relatively small variation in the vertical direction as well, and apparently is a very stable landmark.

A certain independence in the degree of variation between landmarks representing different tissues well may be expected (bone and teeth). The length of maxillary I_1, for instance, to a large degree is independent of the formation of the maxilla. Therefore, areas of variation between anterior nasal spine and the apex of maxillary I_1 differ considerably in spite of their contiguity.

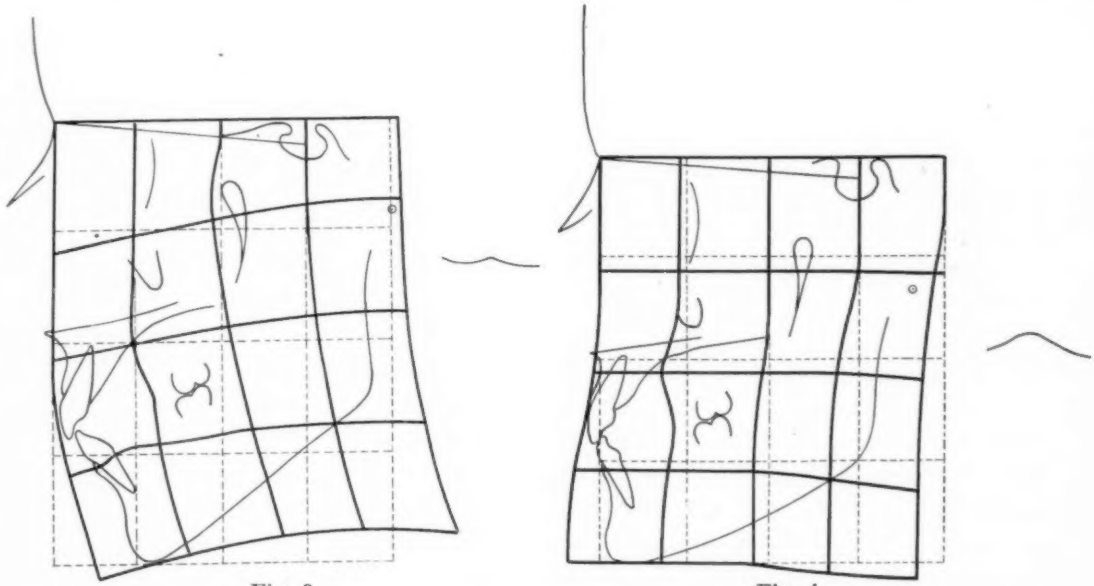

Fig. 3. Fig. 4.

Fig. 3.—Differences between an individual tracing and the average. The dotted lines show a mesh diagram drawn according to the method outlined in this article. The heavy lines illustrate the proportionate differences between this individual tracing and the average facial pattern.

Fig. 4.—Differences between an individual tracing and the average. The dotted lines show a mesh diagram drawn according to the method outlined in this article. The heavy lines illustrate the proportionate differences between this individual tracing and the average facial pattern.

The marked proportional differences which exist in the components of the dentofacial complexes of fifty individuals with normal occlusion can be demonstrated further by comparing individual tracings with the average profile tracing. In order to accomplish this objective, conforming to the procedure followed by D'Arcy Thompson and De Coster, mesh lines of the two individual tracings (Figs. 3 and 4) were redrawn in such a manner that they would assume a similar distance to the landmarks as observed in the average tracing (Fig. 2). The resulting distortions illustrate the proportionate differences that exist between

each of the two individuals and the average. The extent of distortions of the mesh diagrams is considerable and usually is not greater for patients with malocclusion than for the two examples shown, where normal instead of abnormal occlusion prevails.

Björk has shown that variations occur in the shape of the facial skeleton and the shape and size of the cranial base in Swedish men with sagittal bite anomalies. The present study strongly suggests that similar variations also occur in individuals with anatomically normal occlusion. For instance, interpretation of distorted mesh lines in Figs. 3 and 4 reveals similar differences in linear measurements of facial components and angles of cranial base, jaw joint, etc., as observed by Björk. The present study, therefore, shows that normal occlusion is not dependent upon an absence of variations in the dentofacial complex, nor dependent upon a fixed facial pattern. These variations are compensated, however, thereby permitting normal occlusion. This investigation, furthermore, indicates that a better understanding of the abnormal can be obtained only after an understanding of the normal is reached. There are, however, limitations to every approach aimed at this goal, and only a combination of methods may lead eventually to the desired result.

Variation is a biologic phenomenon which can be explained by existing differences in genetic origin and environment; differences in growth and development of the dentition, skull base, and mandible. These differences inevitably must result in a wide range of variation, even in individuals with normal occlusion.

The inferences which can be drawn from the present study should be analyzed with regard to the use made of cephalometric radiographs in diagnosis. Cephalometric radiographs have proved helpful in supplementing the examination of the face. The determination of the relationships between dentition and cranium, advocated by Van Loon, now can be accomplished in a fairly satisfactory manner. Development of the jawbones and position of the teeth in them (incisor inclinations, etc.) can be evaluated better in utilizing cephalometric radiographs than hitherto was possible from a facial and intraoral examination. Furthermore, cephalometric radiographs can provide precise and objective evidence of marked disharmony in the relationships of the maxillary and mandibular basal arches. It is important to obtain this evidence because the presence of marked discrepancies imposes a distinct limitation on treatment procedures by usual orthodontic measures, which cannot affect underlying bony tissues (basal arches).

Cephalometric radiographs, if properly utilized, therefore are of a definite diagnostic value. The main use which is made of cephalometric radiographs, however, is to a large extent only for a descriptive purpose. Individual tracings are compared to the average facial pattern as derived by the previously mentioned investigators, and only the manner in which an individual differs from this average actually is shown.

The present study emphasizes the fact that an average or normal facial pattern is a useful abstraction at best, because of the existing range of individual variations. At its worst, it can be an oversimplified fallacy. One cannot ex-

pect facial patterns of orthodontic patients to conform to this average when individuals with normal occlusions differ from the average, as has been demonstrated in this article. The orthodontist, therefore, should not make this abstraction his treatment goal, but rather should try to minimize existing disharmonies, guided by the patient's own unique facial pattern, instead of by an abstract average pattern. Furthermore, requirements for a meaningful diagnosis are not limited to the anatomic characteristics of patients. The scope of diagnosis has to be broader in order to furnish essential information needed for proper treatment. The treatment plan for patients with anatomic bite anomalies is conditioned by considerations which are nonanatomic in nature. These nonanatomic considerations are different for each patient and are aimed at the establishment of a satisfactory function of the individual patient, as far as his functioning is conditioned by his dentofacial complex. Anatomic criteria are important in evaluating the efficiency of function but, as was pointed out previously, they are not the sole criteria which determine functional requirements. The individually varying ability of patients to adapt themselves to anatomic variations determines to a large degree whether treatment is indicated and to what extent treatment procedures should be carried out. It is obvious, therefore, that more than cephalometric radiographs are needed to solve all diagnostic difficulties.

It is, in fact, to be deplored that the present concept of diagnosis frequently is limited to a comparison of anatomic features in the dentofacial complex of patients to two abstract norms—normal anatomic occlusion and the normal facial pattern. The recognition of prevailing variations at the anatomic level of so-called normal individuals should force us to direct our attention to the more fundamental issues as a prerequisite for a broader concept of diagnosis in orthodontics.

SUMMARY

1. The variations which occur in the dentofacial complex of fifty girls with normal anatomic occlusion were studied with the aid of sagittal cephalometric radiographs.

2. A mesh diagram was designed and the proportionate location of landmarks in their proper mesh rectangles was determined.

3. The extent of variation was demonstrated by drawing concentric ovals for the one and two standard deviation limits computed for each landmark studied.

4. The mesh lines of two individual normal tracings were so drawn as to illustrate the extent of variation in the dentofacial complex of these two individuals.

5. The large extent of variation in individuals with normal occlusions compels one to conclude that an average facial pattern is a useful abstraction at best.

6. The cephalometric radiograph is a valuable diagnostic tool, although all diagnostic problems in orthodontics cannot be solved by the analysis of cephalometric radiographs alone.

7. Future developments aimed at a broadening of the concept of diagnosis in orthodontics should include other than anatomic aspects of the individual patients.

The author expresses his gratitude to Dr. V. O. Hurme for critical reading of the manuscript.

REFERENCES

1. Broadbent, B. Holly: A New X-Ray Technique and Its Application to Orthodontia, Angle Orthodontist 1: 45, 1931.
2. Pacini, A. J.: Roentgen Ray Anthropometry of the Skull, J. Radiol. 3: 230 and 322, 1922.
3. Schwarz, A. M.: Die Auswertung des Fernröntgenbildes, Ztschr. f. Stomatol. 35: 880, 1937.
4. Korkhaus, Gustav: Die Auswertung des Fernröntgenbildes in der Kieferorthopädie, Deutsche Zahn, Mund-, u. Kieferh. 3: 715, 1936.
5. De Coster, Lucien: The Network Method of Orthodontic Diagnosis, Angle Orthodontist 9: 3, 1939.
6. Margolis, Herbert I.: A Basic Facial Pattern and Its Application in Clinical Orthodontics, AM. J. ORTHODONTICS 33: 631, 1947.
7. Downs, William B.: Variations in Facial Relationships, AM. J. ORTHODONTICS 34: 812, 1948.
8. Björk, Arne: The Face in Profile, Sweden, 1947, Lund: Berlingska Boktryckeriet.
9. Van Loon, J. A. W.: A New Method for Indicating Normal and Abnormal Relations of the Teeth to the Facial Lines, Dental Cosmos 57: 973, 1093, 1229, 1915.
10. Wylie, Wendell L.: The Assessment of Anteroposterior Dysplasia, Angle Orthodontist 17: 97, 1947.
11. Andressen, V.: Normbegriff und Optimumsbegriff, Fortschritte der Orthodontik 1: 276, 1931.
12. Thompson, D'Arcy W.: On Growth and Form, London, 1942, Cambridge University Press.
13. Martin, Rudolph: Lehrbuch der Anthropologie, vol. 2, Jena, 1928, Gustav Fischer.
14. Salzmann, J. A.: Principles of Orthodontics, Philadelphia, 1950, J. B. Lippincott Company.

THE FORSYTH DENTAL INFIRMARY,
140 THE FENWAY.

With much regret, we report the sudden death of Clare Madden of Greenwich, Conn. Dr. Madden, who was Vice-President of the American Association of Orthodontists, died of a cerebral hemorrhage.

Editorial

A Paradox

FEW departments in all the health services have wider contrast in viewpoint as to over-all perspective than orthodontics as a department in the dental field. Read the recorded literature, particularly that of the last five years, and you will note profuse diagnostic aids, treatment planning, x-ray charts, and photograph recordings by various authors. You get the over-all impression that current diagnostic routines are complex, to say nothing of the step-by-step plan of treatment that is presumed to be a result of such careful recordings.

On the other hand, you may make a model, fit an appliance to the model, or have one made by the laboratory, and make a quick diagnosis by rule of thumb. Again there is that wide divergence of opinion upon the question of when or when not to extract teeth. Manuscripts written by authors from foreign countries are advocating extraction with considerable abandon, claiming that such a procedure expedites treatment and makes possible orthodontic service for more of the people.

These various paradoxical beliefs recall to mind orthodontic history as written by a small group of workers during the early days of the present century. At about that time Dr. Angle and his followers started the campaign (beamed at dentistry as a whole) to discontinue the practice of unlimited extraction of teeth as a part of the cure for the malocclusion problem. That campaign, and the training program of his students that followed, actually created the first specialty of dentistry, and it was based on the proposition that normal occlusion and the full complement of teeth constitute the "student's most important lesson" and the one that he must not forget if he is to be an orthodontist.

Time changes many, many ideas and concepts. Now we read and hear about the concepts of the modern plastic surgeons who are making some important contributions to the correction of the impact of the aging signs reflected on the faces of people. The plastic surgeons point out in their literature that, when operating to change the facial contour, care should be taken not to draw back the skin of the cheeks too far lest the contour of the mouth be distorted. To do the job properly, the teeth are important, so they say, because, as people mature, the distance between the tip of the nose and the tip of the chin tends to shorten up and the face takes on more of a grim and fixed nonflexible look. Much of this they say can be avoided if the patient is able to maintain all of the teeth. If that is not possible then they advocate restorations with prosthesis in order that the mouth contour will not "cave in" with such shocking velocity as the years advance.

Here then is another paradox. Dentists sometimes advocate the extraction of some teeth in the teens to help correct malocclusion, and then, after the bloom of youth, plastic surgeons hold that as many of the teeth as possible should be retained to keep the facial and maxillary bones of the mouth and face from taking on an edentulous look.

Anyway, one thing is certain—the full impact of the overextraction of teeth in childhood does not really manifest itself in facial contour until age reflects atrophy of the osseous and elastic tissue, the nasal tip goes down, and the upper lip shortens. The cartoonists know all about that.

Any family dentist who has taken care of families through one growing-up generation knows that the more and the earlier teeth are extracted for the child, the greater the acceleration of maxillary atrophy in the adult. That is why all dentists abhor the extraction of the upper canines.

The extraction of teeth in orthodontics, under proper circumstances, has added much to the science and art of our profession. However, it can go overboard if not tempered by common sense and mature judgment as to the maxillary compensation that ultimately manifests itself. Nothing ages so fast as a baby growing up, or a "baby" in her forties growing old, sans her eye teeth.

The plastic surgeons are pinpointing something clinical that practical dentists have been observing every day for many years and it is a fact, not a paradox, that as the teeth go out so out goes the alveolar process. However, the latter requires much more time to make the resultant impact between the tip of the nose and the point of the chin obvious to the eye.

H. C. P.

Protect Yourself and Your Interests*

ORTHODONTISTS, as a professional group, are improvident, impractical, and unbelievably wasteful. This is not a statement made carelessly or in idle criticism. On the contrary, I make the statement thoughtfully, dispassionately, and without prejudice in the hope of attracting attention to what should be obvious facts. During our lives we work diligently and prudently, and give our almost undivided attention to three aspects of professional pursuit: to find pleasure in rendering competent service to our patients, to live graciously, and to make adequate provision for our families. It is in this last-mentioned endeavor that we fail so pitifully. We fail, not through intent but through overconfidence, carelessness, and folly. Regardless of the causes, it is true that upon the termination of our lives, we do, for the most part, waste the substance for which we have strived assiduously during our productive years.

This is not an attempt to outline investment procedures, savings plans, or ways of preserving wealth. I am in no position to do that; nor would it be fitting were I to attempt it, even though qualified. My purpose is to bring to

*This editorial was written at the request of the editor of the JOURNAL. Dr. Dillon has had wide experience and great interest in the formulating of the booklet which all members of the American Association of Orthodontists have received.

light as emphatically as possible the need for all of us to put our houses in order and keep them that way, permanently. Perhaps I am peculiarly well fitted for this task by a series of misfortunes which befell the members of the Pacific Coast Society of Orthodontists during my term as president. In that brief two-year period, death and its tragic sequelae struck with relentless frequency. The Necrology Committee, having no authority and no precedent as to procedure, acknowledged with regret the passing of these men and closed the book on their memberships. This was not enough. As president it became my self-assumed and sorrowful privilege, assisted by friends of the deceased, to act as advisor and buffer between the bereaved, bewildered survivors and the clamorous demands made upon them from all sides. That I was able to help in a small way is to my credit, but for the most part I found myself unable to prevent needless heartache and financial loss resulting from the chaotic condition in which the estates were left. Lest it be supposed that I am exaggerating the importance of an orderly house and the need for the booklet compiled under the thoughtful guidance of Dr. Herbert, I shall list some of the situations encountered.

Deceased died intestate.

Last will and testament, if any, not recorded, inaccessible, or location unknown.

No independent bank account for widow or other survivors.

No provision made for monthly withdrawals to sustain relicts.

Court action required to establish subsistence withdrawals.

No record of bank accounts. Pass books to banks not on record.

Office bank account inactivated pending litigation over reimbursement and/or malpractice claims.

Tax records not on file consecutively.

Financial records impounded and removed from premises by Department of Internal Revenue.

No record of investments, titles, or personal property.

No record of insurance policies, including life and malpractice insurance.

Patients' records inaccessible or nonexistent.

Office safe and filing cabinets sealed pending investigation by Department of Internal Revenue.

Safe deposit box number not recorded.

Safe deposit box sealed by Department of Internal Revenue.

Office sealed pending investigation of accounts.

Attorney and court action required to search out assets.

Attorney and court action required to quell suits, institute countersuits, reply to claims, file counterclaims, referee for reimbursement of unfinished, paid-in-full cases.

Delayed and complex probates.

Exaggerated appraisal of estate by court-appointed appraiser.

These are the outstanding obstacles. Each one of them, and there are more, adds to the expense, confusion, and sorrow in the settlement of an estate. Each one exacts a heavy toll of financial, physical, and emotional resources.

Pursuing the effort to find a solution to this poignant problem, I took it to the Boards of Directors of the Pacific Coast Society of Orthodontists and the American Association of Orthodontists. In both instances my pleas were heeded and very competent Necrology Committees went to work. The results of their efforts were submitted to Dr. George Herbert and are now in the hands of each member of the American Association of Orthodontists in the form of a concisely worded booklet containing fifteen pages to be filled out carefully and thoughtfully. *Do not put this booklet aside to be completed at a future date.* Do not assume that your life is interminable and that you have ample time to take care of your responsibilities. Do not assume that the data required to fill the pages of this booklet are inconsequential. Any man who can and will fill out all the pages of this small booklet completely will find himself in a sound position and can feel he has done much to provide protection so that his legatees will not be subjected to harassment from foreseen and unforeseen claimants.

It is not to be supposed that the booklet distributed by the Necrology Committee of the American Association of Orthodontists will solve all of the problems, but it can and will make it possible for each one to institute and execute a practical and helpful plan for orderly estate settlement. From it and its use should come even more tangible and concrete methods for preserving the fruits of our work, our studies, and our lives. Use the booklet and keep it safely in a place other than the office or safe deposit vault. Keep it where it will be accessible at a moment's notice and not subject to impoundment.

My thanks to Dr. Herbert and his committee for putting into usable form the work of many men. Also, my thanks to him and Drs. Pollock and Shepard for inviting me to express my thoughts on this subject.

C. F. Stenson Dillon.

Facial Asymmetry in the Newborn

THE orthodontic significance of facial asymmetry in the newborn has received more than passing attention from orthodontists over the years. With the increasing concern to the esthetics of facial appearance in treated patients, this subject has assumed even greater significance. Boder, in an article published in this issue of the JOURNAL, presents her findings on facial asymmetry based on a study of 1,425 newborn infants in Los Angeles and Mexico City. This article throws new light on the significance of presence habits as a causative factor in malocclusion.

Within recent years the effect of undue pressure on the dentofacial area has again been questioned. There are those who claim that prolonged and persistent thumb-sucking, for example, does not necessarily cause malocclusion. While that may be so in certain cases, we must heed the words of Boder, who calls attention to the fact that ". . . osteoporosis, or deficient bony calcification,

may be an essential factor predisposing the child at any age level to malocclusions that are due to pressure habits."

Facial asymmetry was found by Boder to be five times as frequent in infants with osteoporotic skulls and more than twice as frequent in those with transitional skulls, when compared with newborn infants with hard skulls. Furthermore, facial asymmetry was found twice as frequently among the offspring of primiporas than among multiporas. This confirms the opinion that sustained intrauterine pressure is a causative factor in facial asymmetry since the pressure is greater in primiparas than in mothers who had previous pregnancies.

Boder points out further that ". . . since congenital cranial osteoporosis predisposes to dentofacial asymmetry and chest deformity due to pressure effects prenatally, it may, if uncorrected, predispose the infants postnatally to the early head and dentofacial deformities that are due to postural pressure habits." An interesting observation made by Boder, not previously found in pediatric literature is one to the effect that the heads of premature infants often become narrowed laterally due to postural pressure because of their incompletely calcified, osteoporotic bones at birth.

Boder's article brings nutritional status of the infant into closer relationship to the malocclusion which frequently develops in children who have experienced prolonged early malnutrition. Dietary correction may then be looked upon as a preventive orthodontic measure, and one that can be prescribed for the expectant mother, in addition to the other benefits which the child derives from adequate diet.

We can carry Boder's observation further as it applies to orthodontic therapy in the individual child. Orthodontists have long been plagued by patients who respond only too readily to treatment but in whom relapse follows as soon as the appliances are removed.

This has been found to occur in patients treated according to any system of mechanotherapy and by many competent orthodontists. It would seem that a knowledge of the osteogenic status of the patient must be linked to the method of treatment and ultimately to the permanence of the result obtained. It has long been an accepted dictum among orthodontists that the easiest thing to do is to move teeth. To keep them in their new position presents the real problem. The answer may well be found, as Boder suggests, in the osteogenic status of the patient which will have to be corrected if successful response to orthodontic therapy is to be obtained.

J. A. Salzmann.

Department of Orthodontic Abstracts and Reviews

Edited by

Dr. J. A. Salzmann, New York City

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

Abstracts Presented Before the Research Section of the American Association of Orthodontists, April, 1952.

Early Changes Following Tooth Movement in Rats: By Luz C. Macapanpan, D.M.D., Department of Orthodontia, University of Illinois, Chicago, Ill.

This study is based on histologic examination of serial sections of the upper molar teeth of thirty-five male rats 65 days of age. A strip of rubber dam 1 mm. in width was inserted between the upper right first and second molars. Since the molars of the rat drift distally, the force applied increased this distal drift in the second and third molars, while it reversed the drift in the first molar. The left side served as control. To compare horizontal and mesiodistal sections, two animals were sacrificed after 1, 3, 6, 12, 24, 36, 48, 60, and 72 hours. After routine fixation and decalcification, the sections were stained with hematoxylin and eosin.

The following observations were made:

A. *Direction of Movement.*—The molars were moved bodily with a slight tipping movement from a fulcrum situated in the alveolar bone beyond the apices of the roots. The number, spatial arrangement, relative strength, and divergence of the component roots seem to determine the movement of multirooted teeth.

B. *Cementum.*—No differences were found in the incidence and location of cementum resorptions which occurred, in the majority, on the distal sides of the roots.

C. *Periodontal Membrane.*—Hyalinization of the periodontal membrane was observed on the pressure side as early as one hour after the beginning of the experiment. At sixty hours, areas of complete obliteration of the periodontal membrane were noted. None were found in the controls.

D. *Bone.*—Resorption of bone in the marrow spaces of the interradicular septum of the first molar and in the septum between the first and second molars was observed already after three hours. At twelve hours, the process of resorption normally seen at the alveolar bone facing the distal side of the roots of the first molar was arrested. This area, normally an area of pressure, had become an area of tension. In this area, after twenty-four hours, spicules of osteoid tissue had formed between the principal fibers in the area of their attachment. On the mesial side of the first molar, the normal area of tension had changed to an area of pressure. Thirty-six hours after the start of the experiment, the first evidence of active resorption was observed on this area in those regions which had not undergone hyalinization. The alveolar bone of the second and third molars showed intensified signs of physiologic distal drift.

E. *Mitotic Activity in the Periodontal Membrane.*—After an initial decrease in the number of mitotic figures in the periodontal membrane of the experimental animal, their number again increased until twenty-four to thirty-six hours after the experiment a peak was reached. At that time one could count three times as many mitotic figures in the experimental animals as in the controls. In the control animals, mitotic figures were found almost evenly distributed on all sides of the roots. In the experimental animals where the periodontal membrane undergoes early degeneration, the mitotic figures were localized almost exclusively on the tension side. The changes in mitotic activity seem to parallel the need for fiber formation and bone apposition. Not only osteoblasts and osteoclasts, but also fibroblasts, play an important role in the movement of teeth because they are concerned with the formation of fibers that attach the teeth to the socket throughout the whole movement of the tooth.

A Cephalometric Investigation of Central Australian Aborigines Using a Roentgenographic Technique: By A. H. Craven, B.D.S., D.D.S., M.S., University of Illinois, Chicago, Ill.

The Australian aborigine has been described as a prototype for the living races of man. Thus, the availability of lateral cephalometric roentgenograms of fifty-six living, pure, Central Australian aboriginal children and adolescents permitted comparison with other living races.

The material was divided into sex and age groups.

The facial structures and profile were investigated using the method outlined by Bjork in 1947, and the cranial outline was examined by a geometric form based on established craniometric landmarks.

Variations of the cranium, facial structures, and profile were determined in the aborigine and compared with the findings in other races. The aboriginal facial structures and profile were less variable than those of the Swede, but similar combinations of the variable facial structures were found.

Differences between the male and female aborigine were most apparent in the cranial outline, but the facial patterns showed no significant difference in form.

The mean cranial and facial patterns of the aboriginal child and adolescent were compared. The frontal portion of the cranial outline receded with age, and the degree of alveolar prognathism, relative to facial prognathism, increased with age in the aborigine.

Comparison of the mean facial patterns of the adolescent aborigine, the adult Swede, and the adult Bantu revealed interracial differences in the component parts of the lower face and in the degree of alveolar prognathism. However, intraracial variation was greater than interracial variation of the mean facial patterns. The degree of prognathism of the maxillary base, the inclination of the palatal plane, and the percentage of upper face height to total face height showed little interracial variation. Similar conditions were found in the comparison of the younger age groups.

Further Studies on the Morphology of Angle Class I, Class II, Division 1, and Class II, Division 2 Malocclusions: By E. S. Blair, D.D.S., Department of Orthodontia, University of Illinois, Chicago, Ill.

Angle's classification of malocclusion, based on tooth position, solved some orthodontic problems and suggested many more. This is demonstrated by many studies conducted to determine skeletal similarities and differences among the classes of malocclusion. This study was suggested by the many conflictions in sample choice, investigative method, and findings.

The sample chosen included forty Class I, forty Class II, Division 1, and twenty Class II, Division 2 malocclusion cases, with equal division of sexes and an age range of 11 to 14 years. Lateral cephalometric headplates were traced and analyzed by angular measurements from reference plane, Sella-Nasion, to various facial points. Linear measurements were employed to determine mandibular size and relative position of the lower first permanent molar. Means and standard deviations were obtained for each sex grouping and each malocclusion class. The means were tested for statistical significance. The following findings represent a composite of the significant differences found.

The sexes differed only in greater linear measurements in boys.

The inclination of the lower mandibular border was greater in Class I than in Class II, Division 1.

In contrast with Class I, analysis of Class II, Division 2 revealed a much smaller gonial angle, this dimension probably contributing to: (1) the reduced effective mandibular length, (2) the more horizontal lower mandibular border, and (3) the forward position of gnathion seen in Class II, Division 2. Subspinale was also forward in Class II, Division 2.

Similarly, Class II, Division 2, in contrast to Class II, Division 1, presented a more acute gonial angle, a more horizontal mandibular border, and a more forward position of gnathion.

The position of the lower first permanent molar relative to the mandible was the same in all malocclusion classes studied.

Thus, no differences in mandibular size and positioning were shown except those resulting from the decreased gonial angle in Class II, Division 2. Although significant differences in malocclusion classes were found, no single facial dimension was shown to play a constant role in the production of a malocclusion type.

News and Notes

American Association of Orthodontists

The following is a program supplement for the annual meeting held in Dallas, Texas, in April, 1953.

TUESDAY, APRIL 28
7:30 P.M. RESEARCH MEETING
Columbia University
Orthodontic Department
New York 32, N. Y.

The Experimental Study of the Changes in the Mandibular Fossa of the Rat Following Unilateral Condylectomy. Arthur M. Hayes.

The Movement of Devital Teeth in the Macacus Rhesus Monkey. Robert J. Huettner.

University of Illinois
Dept. of Oral and Maxillofacial Surgery
Chicago, Ill.

Growth Pattern of the Pig Mandible: A Roentgenographic Study Using Metallic Implants. Irwin B. Robinson and Bernard G. Sarnat.

Growth at the Fronto-Nasal Suture of the Rabbit: Gross and Serial Roentgenographic Study by Means of Metallic Implants. Abbe J. Selman and Bernard G. Sarnat.

Growth of the Rabbit Snout After Extirpation of the Fronto-Nasal Suture. Abbe J. Selman and Bernard G. Sarnat.

Change of Volume After Extraction of Teeth Adjacent to the Maxillary Sinus in the Dog. Marvin Rosen and Bernard G. Sarnat.

A Fourteen-Year Report of Facial Growth in a Case of Complete Anodontia and Ectodermal Dysplasia. Bernard G. Sarnat, Allan G. Brodie, and W. Howard Kubacki, Departments of Oral and Maxillofacial Surgery, Orthodontia and Prosthodontia.

Mandibular Growth in the Cleft Palate Infant. Gerald H. Borden.

Behavior of the Cranial Base and Its Component Parts as Revealed by Serial Cephalometric Roentgenograms. Allan G. Brodie, Jr.

The Relationship of Sinus Area to Facial Area. Jerome Fein.

Embryological Evidence for the Absence of the Premaxilla in Man. Alexander Jacobson.

Relative Growth Rate (Height) of the Alveolar Processes in Man. Roger Xavier O'Meyer.

Changes of the Bony Facial Profile Coincidental with Class II Division 1 (Angle) Treatment. Abraham Silverstein.

Effects of Maxillary Bite Plane Therapy in Orthodontics. Charles G. Sleichter.

The Width of the Nasopharynx and Related Anatomical Structures in Normal and Unoperated Cleft Palate Children. J. Daniel Subtelny.

The Behavior of the Occlusal Plane and Related Structures in the Treatment of Class II Malocclusions. Byron C. Tovstein.

University of Michigan
Department of Orthodontics
Ann Arbor, Mich.

A Roentographic Mathematical Determination of Bolton Point. David W. Baumgartner and Daniel J. Bouchner.

The Effect of Sectional Size and Shape on the Mechanical Properties of Stainless Steel of Orthodontic Wires. James H. Teetzel.

A Study of Labial Anterior Forces Upon the Maxillary and Mandibular Dentition. James P. Alderision.

Dental Irregularities and Periodontal Disease. William M. Ditto.

Familiar Resemblances in Cranio-Facial Osteology as Revealed by Cephalometric X-Rays. H. N. Haralabakis.

New York University
College of Dentistry—Orthodontic Department
New York 10, N. Y.

A Cephalometric Appraisal of Five Mandibular Resections. William Biederman.

Tufts College
Dental School—Orthodontic Department
Boston 11, Mass.

A Preliminary Report on the Range of Oral Muscle Forces of Children (a) With Various Types of Malocclusion, (b) With Normal Occlusion. Herbert I. Margolis and Prem Praksh.

A Preliminary Report on the Effect of Exercise on Oral Muscles of Children with Malocclusion. Herbert I. Margolis and Prem Praksh.

A Precision Vertical Cephalorotator—an Adjunct to the Margolis Cephalostat for Standardized Roentgenograms of the Temporomandibular Articulation. Herbert I. Margolis.

Standardized Roentgenograms of the Temporomandibular Articulation Demonstrating Condylar Movements Evidenced on the Sagittal Roentgen Cephalograms. Herbert I. Margolis and Samuel Glossman.

A Comparative Study of Density and Porosity of Acrylic Resins Obtained by Pressure and Nonpressure Methods. Ralph W. Galen.

Evidence for Hereditary Factors in Facial Conformation. Kathryn F. Stein and Thomas Kelley, Zoology Department Mount Holyoke College and Department of Graduate Orthodontics, Tufts Dental School.

University of Toronto
Dental School—Orthodontic Department
Toronto 2-B, Canada

A Comparative Electromyographic and Cephalometric Analysis of Distoclusion at Two Age Levels in Children. R. D. Haryett.

A Cephalometric Study of the Location of the Maxillary and Mandibular First Permanent Molars in Relation to Their Respective Jaws, in a Series of Clinically Excellent Occlusions. B. Hemrend.

A Cephalometric Appraisal of the Movement of the Maxillary Central Incisor in Class II, Division 1 Cases Treated With Edgewise, Twin-wire, and Labiolingual Techniques. M. A. Matthews.

The Mandibular Morphology of Distoclusion. D. J. E. Mitchell.

An Evaluation of Lip Pressures on the Maxillary Permanent Incisors. D. B. Morrow.

A Cephalometric Evaluation of Vertical Overbite in the Young Adult. Frank Popovich.

Northwestern University
Dental School—Orthodontic Department
Chicago, Ill.

A Cephalometric Appraisal of the Results of Cervical Gear Therapy. T. M. Graber.

A Cephalometric Study of the Growth and Development in Cleft Lip and Palate Individuals From Birth to Four Years. Raleigh T. Williams and T. M. Graber.

A Radiographic Study to Determine the Relation of Various Cranial Planes to a Natural Postural Position of the Head. Robert W. Donovan.

A Radiographic and Clinical Study of Facial Skeletal Patterns and Various Mandibular Positions in Individuals with Excellent Function and Abnormal Function of the Masticating System. Robert W. Donovan.

A Radiographic and Clinical Study of the Positions of the Condyles in Individuals Exhibiting Malfunctions of the Temporomandibular Joints. Melvin Mayerson.

An Evaluation of a Technique and Its Implication in Interpretation of Radiographs of the Temporomandibular Articulation. Rubin Ruskin.

Certain Effective Orthodontic Techniques Which May Be Used As An Adjunct to Periodontal Therapy. Robert Smythe.

A Clinical and Histologic Study of the Pathology of the Gingivae During Orthodontic Therapy. William Spence.

A Study to Develop a Standardized Method by Which Electromyographic Data May Be Recorded for Serial Evaluation. Bernard Geltzer.

Radiographic and Clinical Study of the Positional Relations of the Mandibular Condyles in Individuals with Excellent Occlusion. Edward Schwartz.

Prize Essay Contest, American Association of Orthodontists

Eligibility.—Any member of the American Association of Orthodontists and any person affiliated with a recognized institution in the field of dentistry as a teacher, researcher, undergraduate, or graduate student shall be eligible to enter the competition.

Character of Essay.—Each essay submitted must represent an original investigation and contain some new significant material of value to the art or science of orthodontics.

Prize.—A cash prize of $500.00 is offered for the essay judged to be the winner. The committee, however, reserves the right to omit the award if, in its judgment, none of the entries is considered to be worthy. Honorable mention will be awarded to those authors taking second and third places. The first three papers will become the property of the American Association of Orthodontists and will be published. All other essays will be returned.

Specifications.—All essays must be typewritten on 8½ by 11 inch white paper, double spaced with 1 inch margins, and composed in good English. Three copies of each paper, complete with illustrations, bibliography, tables, and charts must be submitted. The name and address of the author must not appear in the essay. For purposes of identification, the author's name, together with a brief biographical sketch which sets forth his or her dental and/or orthodontic training, present activity, and status (practitioner, teacher, student, research worker, etc.), should be typed on a separate sheet of paper and enclosed in a sealed envelope. The envelope should carry the title of the essay.

Presentation.—The author of the winning essay will be invited to present it at the meeting of the American Association of Orthodontists to be held at the Palmer House, Chicago, Ill., May 16 to 20, 1954.

Judges.—The entries will be judged by the Research Committee of the American Association of Orthodontists.

Final Submission Date.—No essay will be considered for this competition unless received in triplicate at the following address on or before March 1, 1954: Dr. J. R. Thompson, 311 E. Chicago Ave., Chicago 11, Ill.

John R. Thompson, Chairman, Research Committee,
American Association of Orthodontists,
311 E. Chicago Ave.,
Chicago 11, Ill.

Central Section of the American Association of Orthodontists

The sixteenth annual session of the Central Section of the American Association of Orthodontists was held at the Edgewater Beach Hotel, Chicago, Ill., Oct. 19 and 20, 1953.

The scientific program for Monday, Oct. 19, 1953, follows.

ADDRESS OF WELCOME by Dr. James W. Ford, President of American Association of Orthodontists.

PRESIDENT'S ADDRESS.

A CRITICAL REVIEW OF CEPHALOMETRICS. Dr. Alexander Sved, D.D.S., New York, N. Y.

CASE REPORTS: DEMONSTRATING

(1) A SUCCESSFUL RESULT

(2) AN UNSUCCESSFUL RESULT. Dr. John R. Thompson, D.D.S., Chicago, Ill.

(NOTE: The above programs were presented by the Chicago Association of Orthodontists to the Central Section. Dr. Frederick Marich, President, and Dr. William Ford, program chairman.)

CLINICAL APPLICATION OF RECENT DIAGNOSTIC RESEARCH IN THE TREATMENT OF DENTOFACIAL ANOMALIES. Robert W. Donavon, D.D.S., M.S.D., Ph.D., Chicago, Ill.

Clinical Sense, developed during many years of successful orthodontic practice, consists, to a large extent, of a long list of things not to do, because this learning process is one of trial and error. *Clinical Research,* on the other hand, is the systematic quest for information that may or may not have a practical application.

Basic research, clinical research, and clinical sense all contribute to a system of diagnosis. Of the many items under the heading of diagnosis, the following will be discussed in relation to recent research: stomatognathic function, cephalometrics, growth prognosis, dental measurements, tooth movement, retention, appliances, and etiology.

THE ROLE OF DENTOFACIAL GROWTH AND DEVELOPMENT AS POSSIBLE LIMITING FACTORS IN ORTHODONTIC TREATMENT. Wilton Marion Krogman, Ph.B., M.A., Ph.D., Professor of Physical Anthropology, The Graduate School of Medicine, University of Pennsylvania, Philadelphia 4, Pa.

It should be axiomatic:—Treatment *with* growth, not *against* growth. This presupposes a knowledge of time-linking in growth and development, both generally (systemic) and specifically (cephalo-facio-dental) so that periods of maxima and minima are known. Further, the interrelation of endogenous and exogenous factors must be understood. To this need be added the intrinsic variability of organic substance during the growth phase. From all this the concept of individual pattern or configuration emerges.

TREATMENT FORUM.

All pretreatment records of cases will be on display Monday for members to look at and plan treatment as they would do it. Tuesday morning, from 9:00 to 11:00, the panel will discuss the cases. First, a panel member will present only the original records. Then, each member of the panel will give his way of treating the case. Then the man who treated the case comes back and tells us (and all the other second guessers, too) how he actually treated the case; each participant will prepare two cases.

T. M. Graber, Moderator
Participants:
Dr. Howard E. Strange, Chicago, Ill.
Dr. Beulah Nelson, Oak Park, Ill.
Dr. Silas J. Kloehn, Appleton, Wis.
Dr. Earl E. Shepard, St. Louis, Mo.

PREDETERMINATION OF TOOTH SIZE BY RADIOGRAPHS. William S. Brandhorst, D.D.S., St. Louis 8, Mo.

Pacific Coast Society of Orthodontists

Northern component meets second Tuesday of March, June, September, and December.
Central component meets second Tuesday of March, June. September, and December.
Southern component meets second Friday of March, June, September, and December.

OFFICERS

President	Arnold E. Stoller, Seattle, Wash.
President-Elect	A. Frank Heimlich, Santa Barbara, Calif.
Vice-President	Vernon L. Hunt, Eureka, Calif.
Secretary-Treasurer	Raymond M. Curtner, San Francisco, Calif.

NORTHERN COMPONENT

The Pacific Northwest Study Group had a two-day meeting in Victoria, B. C., September 12 and 13. The boat ride from Seattle to Victoria really is beautiful when the sun is bright. It takes about four and one-half hours on Puget Sound. And in Victoria they hang out the honest Old English welcome sign in such a quiet and unobtrusive manner that you can't help but relax a little. There are big baskets of summer flowers hung from each lamppost, afternoon teas with music at the old Empress Hotel, and horse-drawn sight-seeing vehicles.

The usual local or near-local group was there—Arnie Stoller, Don Mac Ewan, Howie Hammond, Chip Chipman, Jim Keenan, Ralph Cooper, George Barker, E. B. Faxon, Joe Harrison (from Thurm Hice's town while Thurm is in the Service, stationed at Denver), and John McKinnon. Our Canadian brothers, Dick Cline, Lloyd Chapman, Percy Rumball, and Ben Nickells, made us feel at home. From south of here we were honored by Charley Linfesty, Aldys Gray, Walt Furie, Lloyd Tocher, Fred West, Hank Bowman, Ric Ricciardi, Paul Husted, Harvey Stollard, and a surprise guest who gave us a few words of wisdom was John McCoy.

CENTRAL COMPONENT

At our meeting on September 7 at the Alexander Hamilton Hotel, Chairman Ray Brownell called the meeting to order at 8:30 P.M. All the guests and new members rose when their names were called. We hope to become better acquainted with our new members.

Chairman Ray Brownell turned the meeting over to Clarence Carey, who carried on as Program Chairman in the absence of Wendell Wylie, who is still on vacation (lucky fellow). Clew introduced the guest speaker, Dr. Virgil Anderson, who is head of the speech department of Stanford University. Dr. Anderson's subject was: ''Speech Defects, Their Correction and Orthodontic Significance.''

His lecture dealt primarily with speech habits and effects probably connected with the malarrangement of teeth. He dealt primarily with speech sounds, their modifications and how affected by associated structures—teeth, palate, lips, etc. Changes in physical characteristics may produce changes in speech sounds. Very often habits, which orthodontists find, are also contributing to speech defects. About 25 per cent have a structural or organic basis. Class III cases need orthodontic help before speech problems can be corrected.

SOUTHERN COMPONENT

On Sept. 11, 1953, the regular quarterly meeting was held at the Unitek Corporation, 275 N. Halstead Ave., Pasadena, Calif. The plant was open for inspection from 1 P.M. until 2:30 P.M., when the meeting was called to order by the chairman, Robert Whitney, who introduced Albert Funk, Program Chairman for the day.

Albert, in turn, introduced the spokesman of the Arizona Study Group, William Tweed, who introduced the rest of the members of their group who participated in a progressive clinic on the "Treatment Technique of a Class II, Division 1 Discrepancy Case."

Graduate Courses in Orthodontics Offered by the Dental Schools of the United States and Canada, 1953

	DENTAL SCHOOL	MINIMUM RESIDENCE REQUIREMENT	AWARD
Calif.	University of Southern California	18 months	M.S. (with thesis)
Ga.	Emory University	24 months	Certificate
Ill.	Northwestern University	15 months	M.S.D.
	University of Illinois	18 months	M.S. and/or Certificate
	Loyola University, Chicago	24 months	Certificate
Ind.	Indiana University	21 months	M.S.
Ia.	University of Iowa	14 months	Certificate
		16 months	M.S.
Mass.	Tufts College	16 months	M.S.D. or Certificate
Mich.	University of Michigan	21 months	M.S.
Minn.	University of Minnesota	21 months	M.S.
Mo.	St. Louis University	21 months	M.S.
	University of Kansas City	14 months	M.S.D.
	Washington University	21 months	M.S.
N. Y.	University of Buffalo	15 months	Certificate
	Columbia University	16 months	Certificate
	New York University	2,200 hrs. (part time)	Certificate
N. C.	University of North Carolina	15 months	M.S. or Certificate
Ohio	Ohio State University	18 months	M.S.D.
Pa.	University of Pennsylvania	16 months	Certificate
		plus 12 mo. precept.	M.S.
	University of Pittsburgh	21 months	M.S.
Tenn.	University of Tennessee	18 months	Certificate
Wash.	University of Washington	15 months	M.S.
Canada	University of Montreal	15 months	Certificate
	University of Toronto	18 months	M.Sc. (Dent.)

Columbia University

A course on the Principles of Occlusion, PD 429, consisting of lectures, seminar conference, and group participation will be given by Professor Lewis Fox and associates on Jan. 13, 14, and 15, 1954, at Columbia University School of Dental and Oral Surgery.

For further information write to Postgraduate Division, School of Dental and Oral Surgery, Columbia University, 630 West 168th Street, New York 32, N. Y.

University of Tennessee

The University of Tennessee College of Dentistry will offer a course in orthodontics leading to a Master of Science degree, beginning Jan. 1, 1954. Further information may be

obtained from Dr. James T. Ginn, Dean of the College of Dentistry, 847 Monroe, Memphis 3, Tenn.

Dental Association of Mexico

Drs. Oren Oliver of Nashville, Tenn., and Boyd Tarpley of Birmingham, Ala., will appear on the program of the Dental Association of Mexico at the next annual meeting.

American Board of Orthodontics

The next meeting of the American Board of Orthodontics will be held at the Palmer House in Chicago, Ill., May 11 through May 15, 1954. Orthodontists who desire to be certified by the Board may obtain application blanks from the secretary, Dr. C. Edward Martinek, 661 Fisher Bldg., Detroit 2, Mich.

Applications for acceptance at the Chicago meeting, leading to stipulation of examination requirement for the following year, must be filed before March 1, 1954. To be eligible an applicant must have been an active member of the American Association of Orthodontists for at least three years.

Notes of Interest

J. Y. Littman, D.D.S., announces the opening of an office for the exclusive practice of orthodontics at 41-08 Bell Blvd., Bayside, Queens, N. Y.

Dr. Thad Morrison, Sr., announces the return to active practice of Dr. Thad Morrison, Jr., from a second tour of duty with the United States Navy Dental Corps, 353 Doctors Bldg., North Court, Atlanta, Ga., practice limited to orthodontics.

John D. Owens, D.D.S., announces the opening of his office, practice limited to orthodontics, 211 E. Harrison, Harlingen, Texas.

Emil O. Rosenast, D.D.S., announces the association of his son, Emil O. Rosenast, Jr., D.D.S., practice limited to orthodontics, Wilson Bldg., 130 N. Broadway, Camden 2, N. J.

Suzanne Rothenberg, D.M.D., wishes to announce the opening of her office at 358 Commonwealth Ave., Boston, Mass., practice limited to orthodontics.

G. Hewett Williams, D.D.S., M.S.D., and Robert L. Williams, B.S., D.D.S., M.S.D., announce the removal of their offices from 817 Elm St. to 811 Elm St., Winnetka, Ill., practice limited to orthodontics.

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The American Journal of Orthodontics is the official publication of the American Association of Orthodontists and the following component societies. The editorial board of the American Journal of Orthodontics is composed of a representative of each one of the component societies of the American Association of Orthodontists.

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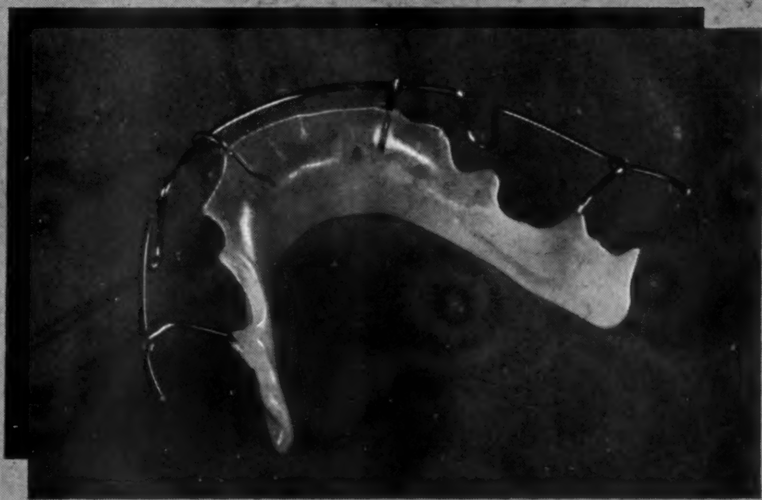

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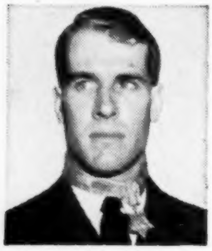

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Peace...

their Christmas Wish for us!

THESE are some of the bravest men on earth. Yet these young holders of the Medal of Honor were never fighters for the love of fighting. They are men of war with a dream of peace.

They want a world in which small wide eyes can gaze in rapture at a tinselled tree. Where a happy Christmas is a child's inalienable right—because fear and force have at last given way to peace and law and goodwill. They have fought ably for peace, with courage "above and beyond the call of duty." Can we, at home, do something for it, too?

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